3. EVALUATION OF OU 3-14 CONTRIBUTING SOURCES

This section summarizes the current understanding of INTEC sites that contribute sources for consideration in the OU 3-14 tank farm soils and groundwater RI/FS. One of the objectives of the OU 3-14 RI/FS is to evaluate the baseline risk to groundwater from the OU 3-13 and OU 3-14 sites in order to support a final remedial decision for groundwater inside the INTEC fence. Because waste was left in place when the Waste Calcining Facility was closed under RCRA, including the closed facility as a source term in the INTEC groundwater model is reasonable. In addition, the OU 3-14 tank farm soil remedy will need to be coordinated with the Idaho HLW&FD FEIS (DOE-ID 2002a) and RCRA tank closures. Information from other tank farm sources (e.g., tanks, piping, sand pads) will be included in remedy selection in the FS so that the final remedy for tank farm soils will be compatible with anticipated RCRA closure of the tanks. However, characterizing sources that are not OU 3-14 sites is outside the scope of this Work Plan. A brief summary of the sources that are not OU 3-14 sites, but will be evaluated in the OU 3-14 RI/FS, is included in this section. Section 4.3 discusses how these sites will be evaluated during the OU 3-14 RI/FS process.

The OU 3-14 tank farm release sites are shown on Figure 3-1. These sites were either assigned to OU 3-14 in the OU 3-13 ROD (DOE-ID 1999a) or defined in the OU 3-14 Scope of Work (DOE-ID 1999b). Information provided on the CERCLA release sites at the tank farm is based on past characterization and process knowledge. Additional information has been obtained as a result of an extensive review of release site files and interviews with tank farm operations personnel. In many instances, these data provide reasonably conservative estimates of contamination remaining at each release site. For some sites, information is insufficient on the release source, the nature and extent of contamination, and/or analytical data on the more mobile contaminants such as I-129 and Tc-99. In the cases where analytical data on the more mobile radionuclides are lacking and process knowledge is available, radionuclide ratios based on Cs-137 concentrations will be used to estimate original release masses of mobile constituents. For example, the Cs-137/I-129 ratio for tank farm waste is approximately 1,000,000:1, while the Cs-137/I-129 ratio for PEW condensate is approximately 10:1. These ratios are typical of the two waste streams but may be updated on a case-by-case basis as additional data become available.

The OU 3-14 sites with the largest known releases are presented first. Sites that have been recommended for No Further Action at least once in the investigation process are presented last. Following the OU 3-14 site summaries, information on other contributing sources and the baseline risk assessment approach is presented.

3.1 OU 3-14 Soil Contamination Sites

Contamination in tank farm soil resulted from past spills, leaks, and contaminated backfill. Spills have occurred during waste-handling and maintenance operations at the tank farm. Many of the leaks are from incompatible piping that corroded due primarily to contact with acidic waste. The time, duration, and volume of the releases are difficult to determine in some cases. Backfill with relatively low amounts of contamination was sometimes used during tank farm maintenance and contamination removal activities. Typical materials used to backfill tank farm excavations consisted of contaminated soil with

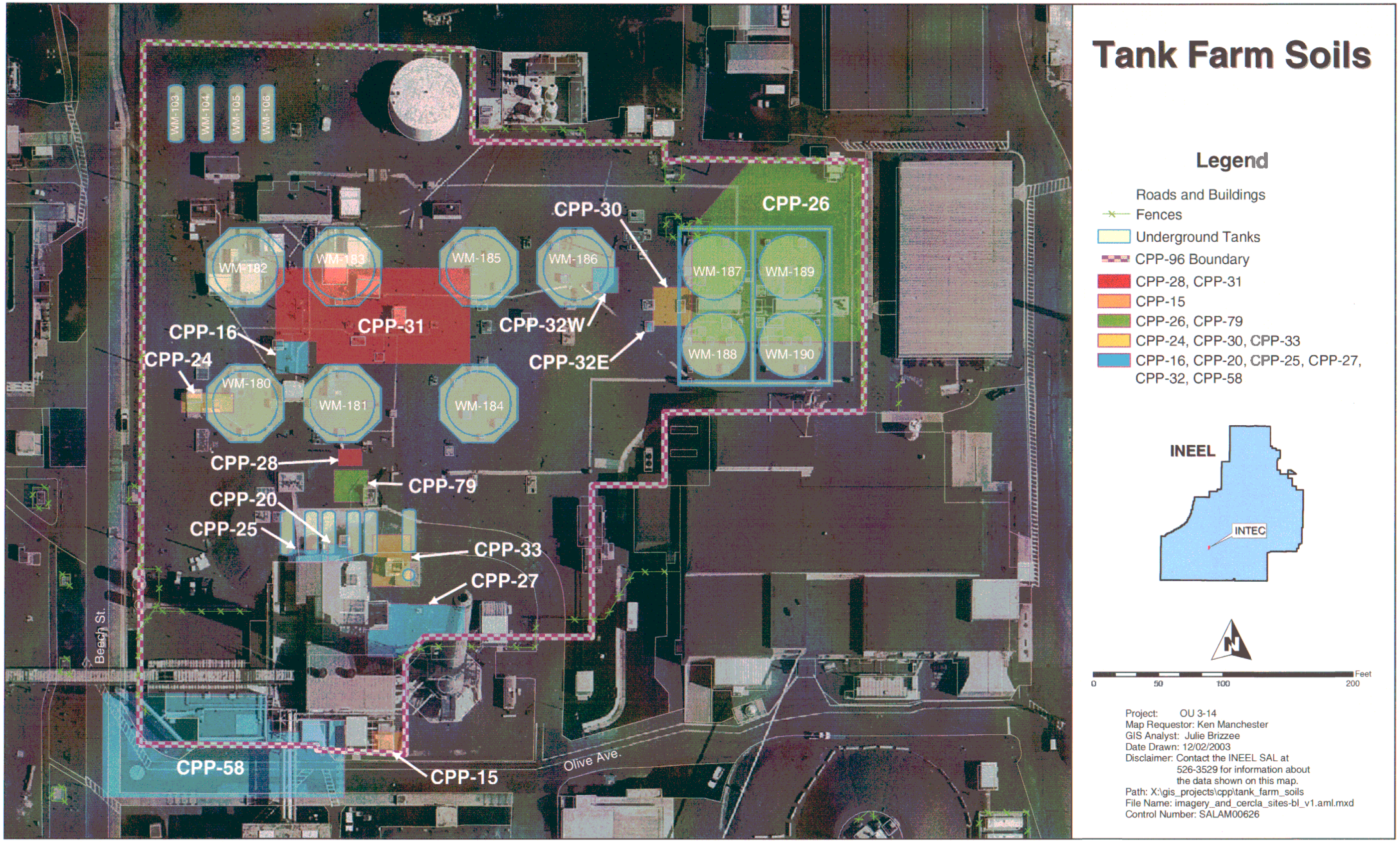

Figure 3-1. Known tank farm soil contamination sites.

contact radiation levels of 3 to 5 mR/hr.[a] This soil was placed in the bottom of excavated areas, and clean soil was placed on top for shielding purposes.

The known tank farm soil contamination sites are summarized in Table 3-1. The individual site descriptions are primarily a composite of the information contained in archived project record files, the OU 3-13 RI/BRA (DOE-ID 1997a), the OU 3-13 Feasibility Study (DOE-ID 1997b), the Feasibility Study Supplement (DOE-ID 1998c), and the OU 3-13 ROD (DOE-ID 1999a). The generating process, release mechanism, and other details are discussed to provide a better understanding of the processes that produced the contamination in tank farm soil.

Previously, three sites, CPP-28, CPP-31, and CPP-79, were determined to contain over 99% of the known radiological contamination (in curies) within the tank farm soils, ultimately driving the risk to groundwater (DOE-ID 1997a). However, review of available project files for each release site and interviews with tank farm personnel suggest that the release at CPP-28 was not as large as previously estimated and may not be associated with the deeper contamination found at CPP-79. Even so, based on the updated estimates presented in the following sections, these three release locations still contain over 99% of the radiological activity.

An attempt was made to determine a source term for each of the known release sites based on process knowledge and past field investigation work for use in an updated fate and transport model and risk assessment. Knowing the particular waste type and the volume lost, a list of radionuclides and their radioactive concentrations can be determined. For comparative reasons, estimates of the Cs-137 and Sr-90 curie content remaining at each site are provided in Table 3-1 and are based on process knowledge, past investigation data, and bounding subsurface structures. By knowing the Cs-137 activity and age of the release and corresponding waste stream, a list of associated radionuclides and their activity levels can be generated.

Details about each of the known releases and their corresponding extents of contamination are discussed in the following sections.

3.1.1 Site CPP-31

Site CPP-31 resulted from a valve inadvertently left open or partially open during a liquid waste transfer in November 1972, allowing the waste to contact a normally isolated carbon-steel line. The waste contacting the line caused corrosion and failure of the line and allowed the release of waste solution into the soil. The release and its investigations are described chronologically below.

In September 1973, 10 monitoring wells (A-40 through A-49) (Figure 3-2) were drilled and installed by the United States Geological Survey (USGS) at various locations in and around the tank farm as part of an effort to learn how water was entering the vaults of certain waste storage tanks. Unfortunately, field records for this series of wells were not found and details of the work are not well documented. The holes were drilled to bedrock using an auger rig and cased with 2-in.-diameter aluminum pipe. The bottom 6 ft of pipe were screened to permit shallow perched water to enter the

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a. R and mR are abbreviations for roentgen and milliroentgen, respectively, which are units for measuring radiation exposure. The measurement is defined for effects on air and applies to gamma measurements in the field.

Table 3-1. Known release sites contained in CPP-96 (from WINCO 1993a; WINCO 1993b; DOE-1997a).

Site	Estimated Curies of Cs-137 and Sr-90 Remaining	Estimated Extent of Remaining Contamination		Analyzed Contaminants	Status of Site Remediation/Characterization	Additional Comments	Past Investigation
		Area (ft^2)	Depth (ft) bgs				
CPP-15 Solvent burner east of CPP-605; release of an unknown volume of solvents and stack condensates Discovered in 1974.	466 Ci	700	20	In 1995, six soil samples analyzed for volatile organic compounds (VOCs), antimony, selenium, thallium, zirconium, nitrate, silver, mercury, Am-241, Eu-154, Cs-134, Cs-137, Co-60, I-129, Np-237, Pu-238, Pu-239/240, Tc-99, Ru-103, Ru-106, Sr-90, U-234, U-235, U-236, and U-238. Co-60, Cs-134, I-129, Ru-103, Ru-106, U-234 and U-236 were not detected. Deepest sample also analyzed for full suite of radioisotopes. Low concentrations of trichloroethene and methylene chloride were the only VOCs detected in the samples. The 1995 sampling was incomplete; only portions of the west side sampled and no sampling performed on east side. No sampling data are available for the eastern portion of CPP-15.	Contamination not completely removed in 1974 soil removal after leak at flange was discovered. During 1983 demolition of solvent burner, an unknown amount of contaminated soil was removed with the solvent tank to a depth of 10 ft bgs. The 1983 soil contamination removal thought to be complete. However, In September 1995, Lockheed Martin Idaho Technologies Company construction personnel encountered contaminated soil in the western half of the site while excavating for an electrical duct bank and transformer pad. The highest activities were detected in a sample collected at 10.5 ft bgs. Cs-137 contamination levels not consistent with the solvent waste stream or stack condensate.	Recommended as a No Further Action site in Track 2 report, based on reported removal of all soil contamination during removal of the solvent burner system. Estimated curies remaining based on soil contaminant concentrations from the 1995 soil sample results and assumes no soils were removed.	OU 3-08 Track 2 and the OU 3-13 RI/FS (WINCO 1993b; DOE-ID 1997a, 1997b)
CPP-16 WM-181 to PEW line valve leak; 3,210 gal of 95% diverted service waste and 5% PEW evaporator bottoms. Leak occurred in 1976.	40.7 Ci	450	~8	Vertical radiation profile measured in 1976 using 1-in. pipe after release, beginning at bottom of valve box at 5.7' bgs. Readings ranged from 19.2 R/hr to 0.15 R/hr. A gamma scan on a soil sample detected Ce-144, Co-60, Cs-134, Cs-137, Eu-154, Ru-106, and Sb-125.	Soil was excavated in 1977 to approximately 7 ft bgs during valve-box replacement. Excavation record incomplete and soil replaced with backfill.	Most of the radioactivity originates from the PEW bottoms fraction of the waste.	Initial release investigation in 1976; OU 3-07 Track 2 and the OU 3-13 RI/FS (WINCO 1993a; DOE-ID 1997a)
CPP-20 CPP-604 radioactive waste unloading area; minor volumes of spilled liquid waste during manual transfers into waste tanks up until 1978.	Contamination removed 0.145 Ci remaining in backfill	205.5	28	No data available because this site was excavated in 1982 without soil sampling being performed. Concentrations of radionuclides are assumed to be similar to concentrations in soil previously excavated in the tank farm. Used 1995 analytical results from 11 tank farm soil samples to represent residual contamination at CPP-20.	Contaminated soils found near valve box C-30 were removed. Spills reportedly cleaned up as they occurred; excavated to 28 ft (to top of CPP-604 tank vault) during tank farm upgrades, replaced with backfill (1982 and 1983–1984). Although the precise area of contamination is unknown, a 1990–1991 radiological survey of the area had no detects above background.	No records describe types, amounts, or exact locations of spills. No records exist verifying effectiveness of cleanup; excavated soil would have removed any remaining contaminated surface soils.	OU 3-07 Track 2 and the OU 3-13 RI/FS (WINCO 1993a; DOE-ID 1997a, 1997b)
CPP-24 Tank farm bucket spill in 1954; approximately 1 gal of radioactive waste solution spilled on ground surface.	Contamination removed <1 Ci	NA	NA	No data available.	Reported site cleaned up using soil removal. Exact location of spill unknown.	Suspected contaminants based on process/spill knowledge. This is a No Further Action site.	OU 3-07 Track 2 and the OU 3-13 RI/FS (WINCO 1993a; DOE-ID 1997a, 1997b)
CPP-25 Contaminated soil north of CPP-604. Location of a ruptured waste transfer line used to transfer waste to PEW.	Contamination removed 0.247 Ci	350	28	This site was excavated during 1981 and 1983 to 1984 tank farm upgrades without soil sampling being performed. Concentrations radionuclides are assumed to be similar to concentrations in soil previously excavated in the tank farm. Used 1995 analytical results from 11 tank farm soil samples to represent residual contamination at CPP-25.	Approximately 9 cubic yards of contaminated soil was removed after the release in 1960. Entire area excavated down to top of CPP-604 tank vault (28 ft) and replaced with backfill in (1982 and partially excavated in 1983–1984); backfill material contaminant levels not well documented; no sampling records.	No records exist verifying effectiveness of cleanup; excavated soil would have removed any remaining contaminated surface soils.	OU 3-07 Track 2 and the OU 3-13 RI/FS (WINCO 1993a; DOE-ID 1997a, 1997b)
CPP-26 Up to 15 gal of first cycle waste was released in 1964 when a steam coupling failed, releasing pressure and liquid waste from a transfer line.	120 Ci	12,850	5	The 1992 Track 2 investigation drilled three boreholes (26 series). Borehole samples analyzed for VOCs, some metals, fluoride, nitrate/nitrite/pH, and radionuclides. Sr-90, Cs-137, and Eu-154 were primary radionuclide detects. Very low levels of Pu-238, Pu-239, and Am-241 detected.	Area disturbed extensively. The portion of the release site nearest the decontamination header was excavated during the construction of buildings CPP-654, CPP-699, and storage Bin Sets 4, 5, and 6. It does not appear that radionuclide contamination has moved downward in the soil. Recent survey of surface shows no contamination.	Area within tank farm is covered with a liner and soil so that suspected contaminated area is 2.5 ft bgs. Area of release was sprinkled with water to mitigate surface contamination.	OU 3-07 Track 2 and the OU 3-13 RI/FS (WINCO 1993a; DOE-ID 1997a, 1997b)

Table 3-1. (continued).

Site	Estimated Curies of Cs-137 and Sr-90 Remaining	Estimated Extent of Remaining Contamination		Analyzed Contaminants	Status of Site Remediation/Characterization	Additional Comments	Past Investigation
		Area (ft^2)	Depth (ft) bgs				
CPP-27 Contaminated soil east of CPP-604 was discovered in 1974. Contamination was mainly from WCF recycled waste and decontamination fluids that made its way into a buried 12-in. carbon steel pressure relief line. The corrosive nature of the liquid corroded the steel, allowing the waste to be released to the surrounding soil.	1.2 Ci	2,000	25	A 1974 radionuclide analysis performed; only Cs-137, Sr-90, and Pu-239/240 would be present today due to radioactive decay. No soil samples were collected during the 1987 borehole investigation. Samples taken in 1990 were analyzed for VOCs, semivolatile organic compounds, pesticides, polychlorinated biphenyls (PCBs), herbicides, dioxins, furans, metals, cyanide, pH, and radionuclides. 1993 samples analyzed for VOCs, metals, fluoride, nitrate, nitrite, pH, and radionuclides. I-129, Tc-99, and Np-237 were excluded in soil analysis.	First soil samples collected during 1974 excavation when majority of contaminated soil was removed. The area was excavated again in 1983 and backfilled with soils having some contamination. In 1987, 10 boreholes were drilled for radiation measurement characterization. Track 2 investigation drilled and sampled three boreholes (CPP-27 series) in 1992. An investigation in 1991 involved drilling and sampling borehole 33-1.	Borehole 27-1 was drilled in an area not previously excavated. Contamination encountered 6 ft higher than reported release for CPP-27/33, indicating a possible new source at borehole 27-1 Boreholes placed in excavation backfill areas show little to no contamination, demonstrating backfill is likely not a risk driver.	CPP-27: OU 3-08 Track 2 and the OU 3-13 RI/FS (WINCO 1993b; DOE-ID 1997a, 1997b)
CPP-28 Leak in first-cycle extraction liquid waste-transfer line; estimated 120 gal released through 1/8-in. hole in waste line to secondary encasement and subsequently to the soil over a period of 18 years. Release discovered in 1974.	720 Ci	65	12	In 1974 six boreholes were drilled to determine extent of contamination. Soil samples were collected from bottom of each hole for beta-gamma radiation measurements. Only one hole had detectable contamination. Metals, organics, and isotope analyses not performed. Eleven soil probeholes were installed after the waste-transfer line was excavated and a portion of the contaminated soils was removed. The probeholes were measured for radiation levels at discrete depths to determine the extent of contamination. Results of the radiation survey indicated that the contamination from the release was limited to a relatively small volume.	Partial soil excavation in 1974 removed approximately 3,000 Ci of total activity, leaving approximately 3,000 Ci of total activity in the release area. Portions of the site also excavated to 15 ft bgs (5 R/hr) between 1993 and 1996. Volume released in question—estimated approximately 120 gal of high-level liquid waste.	Previous work related the contamination found at CPP-79-Deep to the contamination at CPP-28. However, no pathways between the two sites have been identified. The contamination at CPP-28 appeared to be well bounded based on the characterization work completed in 1974. Excavations during subsequent tank farm upgrades did not encounter highly contaminated pathways linking CPP-28 to CPP-79-Deep.	OU 3-07 Track 2 and the OU 3-13 RI/FS (WINCO 1993a; DOE-ID 1997a, 1997b)
CPP-30 Contaminated soil near valve box B-9 was discovered in 1975; result of maintenance personnel placing contaminated equipment and clothing on the ground.	Contamination removed <1 Ci	NA	NA	Unknown if contaminant analysis was performed.	Soil excavated in 1975 and placed in four 55-gal drums that were disposed of at the RWMC. Surface surveys in 1991 and 1992 did not show radiation levels above background.	No records to verify the effectiveness of soil removal.	OU 3-07 Track 2 and the OU 3-13 RI/FS (WINCO 1993a; DOE-ID 1997a, 1997b)

Table 3-1. (continued).

Site	Estimated Curies of Cs-137 and Sr-90 Remaining	Estimated Extent of Remaining Contamination		Analyzed Contaminants	Status of Site Remediation/Characterization	Additional Comments	Past Investigation
		Area (ft^2)	Depth (ft) bgs				
CPP-31 14,000 gal of second- and third-cycle extraction waste and PEW evaporator bottoms released to the soil south of WM-183 in 1972. During a waste transfer, a valve was left partially open, allowing some of the waste to come into contact with a carbon steel drain line. The drain line corroded and allowed the release of waste into the soil.	23,800 Ci	10,550	25	Thirty-three wells installed in 1975 to investigate site. Soil samples taken and analyzed for radionuclides. Direct radiation readings also taken. Additional observation wells (81 series) were installed in 1980s. The 1993–1994 investigation installed borehole A-60 to delineate the western edge of CPP-31. This borehole was sampled for radiological contaminants; results from A-60 not characteristic of CPP-31. Organics, metals, and RCRA constituents were not sampled during any of the investigations.	Carbon-steel line cut and capped at the valve in 1975; boreholes installed to delineate extent of contamination. No documented cleanup. Most of the contaminated soil is 10 to 25 ft bgs.	CPP-31 is one of the most significant sites with respect to the transport of plutonium and Sr-90 to the perched water zones and the SRPA. Soil samples collected for radiological analysis were collected from the soil that was brought to the surface by the auger flights. The soil samples collected were likely contaminated soil mixed with potentially uncontaminated soil. The results indicate the general type of contamination present.	OU 3-07 Track 2 and the OU 3-13 RI/FS (WINCO 1993a; DOE-ID 1997a, 1997b)
CPP-32E Contaminated soil adjacent to valve box B-4 discovered in 1976; release of contaminated water vapor condensate from B-4.	0.0017 Ci	14	5	Borehole drilled and soil samples collected at two depths in 1992. Analyzed for VOC, metals, and radionuclides. Initial radiation levels on the soil measured up to 2 R/hr.	Area has been covered with the tank farm membrane in 1977. No documented cleanup. Standard procedures at the time of the release would have been to remove the limited amount of contaminated soil, reducing worker risk.	Field radiation readings peaked between 1.4 and 2.9 ft bgs at 900 cpm beta/gamma. Readings decreased in the 2.9- to 5-ft interval to 250 cpm.	OU 3-07 Track 2 and the OU 3-13 RI/FS (WINCO 1993a; DOE-ID 1997a, 1997b)
CPP-32W Contaminated soil northwest of valve box B-4 discovered in 1976; result of a leak of radioactive liquid from a aboveground transfer line used to pump water from WM-187 tank sump to the PEW evaporator.	0.02 Ci	6	unknown	The Cs-137 concentration of the water transferred from WM-187 to the PEW in December 1976 had a Cs-137 concentration of 0.00064 Ci/L based on a 2.376×10^{4} d/s/mL analytical result for a tank vault sump water sample collected in August 1976. Surface radiation readings up to 2 R/hr recorded during initial site investigation.	Unknown if any cleanup occurred. Standard procedures at the time of the release would have been to remove the limited amount of contaminated soil, reducing worker risk.	Track 2 recommended this site not be investigated at the time. Suggested deferring investigation to comprehensive RI/FS.	OU 3-07 Track 2 and the OU 3-13 RI/FS (WINCO 1993a; DOE-ID 1997a, 1997b)
CPP-33 Contaminated soil northeast of CPP-604 discovered in 1983. Contamination was mainly from WCF recycled waste and decontamination fluids that made its way into a buried 12-in. carbon steel pressure relief line. The corrosive nature of the liquid corroded the steel, allowing the waste to be released to the surrounding soil.	Contamination removed 0.91Ci	1,200	30	Analytical data on excavated soil could not be found. Used 1995 analytical results for 11 soil samples collected to characterize contaminated backfill soil.	Site was entirely excavated down to basalt in 1983, and removed most of the contaminated soil associated with the 12-in. pressure relief line release. Contamination was bounded to the west by building CPP-604, to the south by release CPP-27, and to the north and east by wells A-62 and A-63. Contaminated soil was assumed to be used as backfill material. Residual backfill contamination was considered as source term for this site.	To date, no records or analyses have been found to document backfill contamination or residual contamination in the excavation.	CPP-33: OU 3-06 Track 2 and the OU 3-13 RI/FS (WINCO 1993c; DOE-ID 1997a, 1997b)

Table 3-1. (continued).

Site	Estimated Curies of Cs-137 and Sr-90 Remaining	Estimated Extent of Remaining Contamination		Analyzed Contaminants	Status of Site Remediation/Characterization	Additional Comments	Past Investigation
		Area (ft^2)	Depth (ft) bgs				
CPP-58W - 1954. PEW condensates leaked to the ground in 1954 at a pipe crossing where 14,400 gal were estimated released from the 10-in. cement line. The leakage included PEW condensate mixed with clean cooling water and steam condensate.	2.66×10^{-5} Ci	Unknown	Unknown	Radiation readings on the leaking pipe were 25 mR/hour but no other radiation readings were recorded. No soil or water samples were collected for analyses.	Contamination from CPP-58 1954 is assumed to have been left in place. No records of contaminated soils being removed were found. The 10-in. cement line was repaired by replacing a 30-ft section with 10-in. carbon steel.	The leak occurred during the installation of new tank farm piping. The new piping crossed under the former PEW condensate line running out of the north side of CPP-604. It is speculated that the leak started during or after the pipe was exposed.	None
CPP-58E Approximately 20,000 gal of PEW condensates headed for service waste were released in 1976 due to a failed pipe elbow.	0.0028 Ci	Unknown	46	During the 1992 Track 2 investigation, only the CPP-58E site was analyzed for contaminants. Thirteen samples were taken from two boreholes and analyzed for VOCs, metals, fluoride, pH, nitrate/nitrite, and radionuclides. Cs-137 concentrations ranged from 0.269 to 63.1 pCi/g. Sr-90 concentrations ranged from 0.877 to 33.4 pCi/g. Based on the monthly (September 1976) amount of Cs-137 and Sr-90 disposed via the PEW condensates, an average per gallon activity for the condensate was calculated; for Cs-137: 1.55×10^{-7} Ci/gal; for Sr-90: 1.30×10^{-7} Ci/gal	No contaminated soil removal activities have occurred at this location. The total activity at this site is small, consistent with the PEW condensate waste stream.	Process knowledge can be used the estimate the amount of contamination released. The amount of contamination at this site is low due to the low concentrations of radionuclides in the PEW condensates.	OU 3-07 Track 2 and the OU 3-13 RI/FS (WINCO 1993a
CPP-58 New Site During the 2001 TFIA a moist brown material (nitric acid contamination) was discovered near CPP-58E and a radiological area near the west of CPP-58W (Olive Avenue and Beech Street).	None (Included in the release estimates for CPP-58E and -58W)	Unknown	Unknown	During the 2001 TFIA, the brown material (nitric acid contamination) was sampled and analyzed (pH, 2.41; nitrates, 3.67 mg/mL; mercury, 0.639 mg/kg; and Cs-137, 6.98 pCi/g). The results were consistent with past PEW condensate releases identified for CPP-58E. The new radiological area, west of CPP-58W, encountered contamination at 200 and 300 counts per minute (cpm), with a high of 500 cpm. No samples were taken.	The low levels of radioactivity are most likely related to the release of PEW condensate within the CPP-58 release site boundary. PEW condensate water may have migrated along existing utility lines in the area due to the volumes released.	The source of the nitric acid contamination was not found New site information resulted in combining CPP-58E and -58W and revising the boundary to extend farther south and west of CPP-58W.	New Site Identification – Operable Unit (OU) 3-14, Chemical Processing Plant 58 (CPP-58) – Nitric Acid Contamination in Proximity to Group 1 Interim Action (IA) Trench near CPP-604
CPP-79-Shallow Approximately 2,500 gal of dilute calciner decontamination solutions was lost (through split-tile encasement after the waste backed up through valve box A-2) in 1976.	7.0 Ci	~450	30	Soil boring CPP-79-1 drilled near release site during 1992 Track 2 investigation. Soil samples were analyzed for nitrate/nitrite, VOCs, Target Analyte List metals, pH, and radionuclides.	Condensate contained low-level radioactivity, metals, and organic compounds. After 1976 release, condensate analyzed (I-129, H-3, gross beta, and uranium found). Portions of site excavated in 1994. Site well characterized and source well known.	CPP-79-1 was installed approximately 10 ft south of the two lines (3” PUA-1013 and 3”PUA-203) where the release was believed to have occurred.	OU 3-08 Track 2 and the OU 3-13 RI/FS (WINCO 1993b; DOE-ID 1997a, 1997b)

Table 3-1. (continued).

Site	Estimated Curies of Cs-137 and Sr-90 Remaining	Estimated Extent of Remaining Contamination		Analyzed Contaminants	Status of Site Remediation/Characterization	Additional Comments	Past Investigation
		Area (ft^2)	Depth (ft) bgs				
CPP-79-Deep First-cycle wastes likely from former valve box A3A.	Lower limit: 3,807	353	28 to 34 (6 ft)	Gross alpha, gross beta, Cs-137, Sr-90, Eu-154, U-234, U-235, U-238, Pu-238, Pu-239, and Am-241.	Only one data point exists for this release site. Excavations conducted in this area of the tank farm during the 1992 through 1994 upgrade encountered contaminated soils with radiation readings of 5 R/hr.	Previously reported soil contamination readings were incorrect. The highest radiation readings recorded in field logbooks was 1.2 R/hr. The 400 R/hr value presented in the December 2000 OU-3-14 RI/FS Work Plan (DOE-ID 2000b) should have been 400 mR/hr. The source for this release has not been determined. The source may have been from a leaking valve in valve box A3A, in which waste moved downward through split-tile encasement and into the soil through flaws in the encasement.	OU 3-08 Track 2 and the OU 3-13 RI/FS (WINCO 1993b; DOE-ID 1997a, 1997b)
	Upper limit: 13,535	628	28 to 40 (12 ft)				

NA – Not applicable.

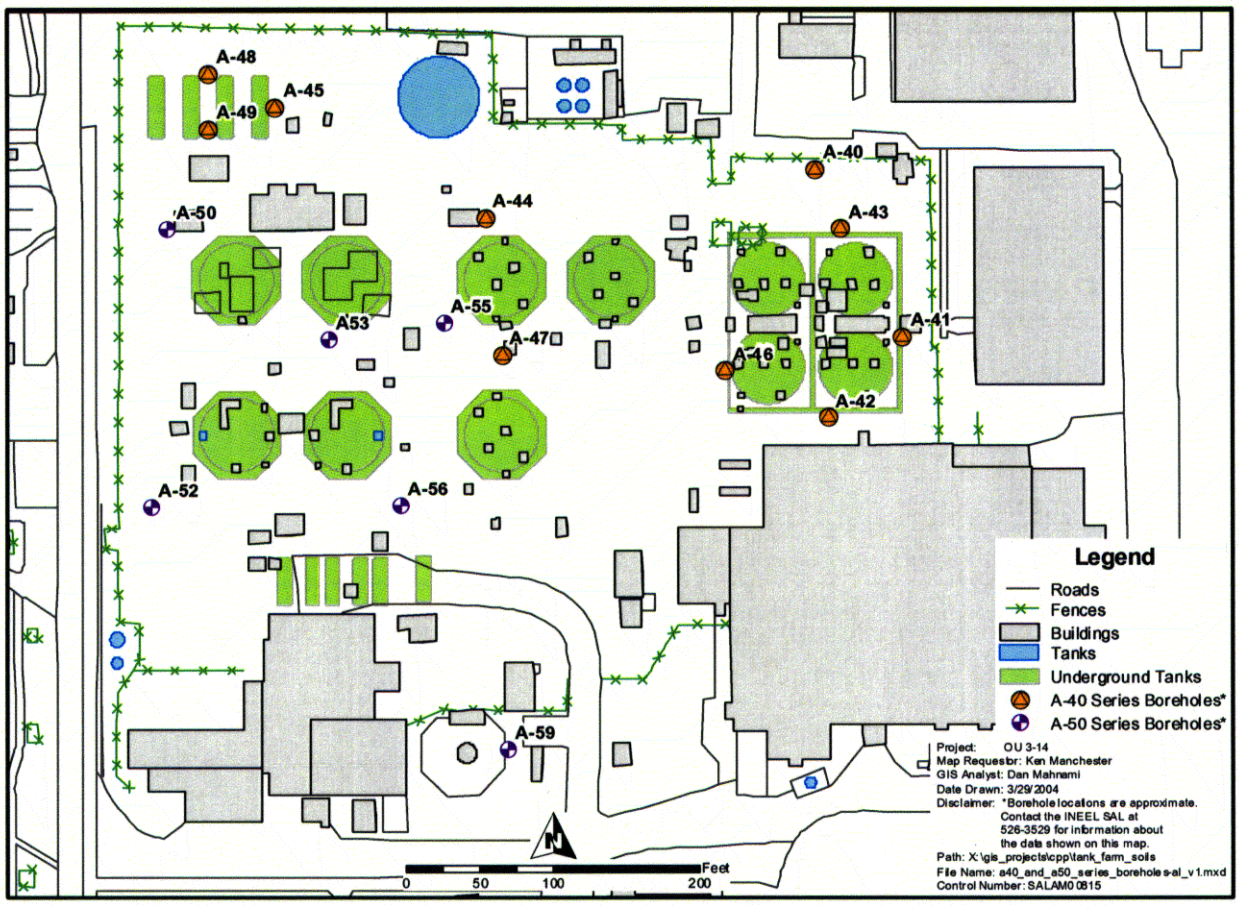

Figure 3-2. Locations of the A-40 and A-50 series wells installed in 1973 and 1975, respectively.

observation well. It is believed that no contamination was encountered in the drill cuttings during drilling of these wells, based on the fact that unusual occurrence reports were not generated for installation of these wells. In addition, the wells were reportedly logged with a down-hole gamma detector resulting in no indication of contamination, but no gamma logging results could be located. As of 1993, wells A-40, -41, -42, -43, and -47 have been either destroyed or removed.

In September 1975, 10 additional monitoring wells (A-50 through A-59) (Figure 3-3) were drilled and installed to extend the monitoring network to the older part of the tank farm. On September 18, 1975, while drilling monitoring well A-53, located approximately 15 ft southwest of tank WM-183 and 10 ft south of the edge of the tank vault (Figure 3-3), contaminated soil was brought to the surface. Beta/gamma radiation levels in the auger drill cuttings reportedly ranged from 100 mR/hr at 15 ft bgs to 500 mR/hr at 22 ft bgs. A radiation profile was taken by lowering a radiation detector into the hollow-stem augers. Readings greater than 10 R/hr were measured at depths of 14, 18, 19, and 23 ft below grade. Well A-55, located southwest of WM-185, also encountered contaminated soil but at lower concentrations than A-53.

Fifteen additional exploratory holes (A-53-1 through A-53-15) were drilled to a depth of 25 ft by the USGS to define the limits of the contaminated area. Soil samples and a radiation measurement plot were collected from each hole. These holes were not cased and were backfilled as the bit was removed. Contaminated soil was encountered in nine of the 15 holes (A-53-1, -2, -3, -4, -5, -6, -10, -13, and -15). Sixteen additional soil probe pipes (A-53-16 through -31) were driven into the ground between early

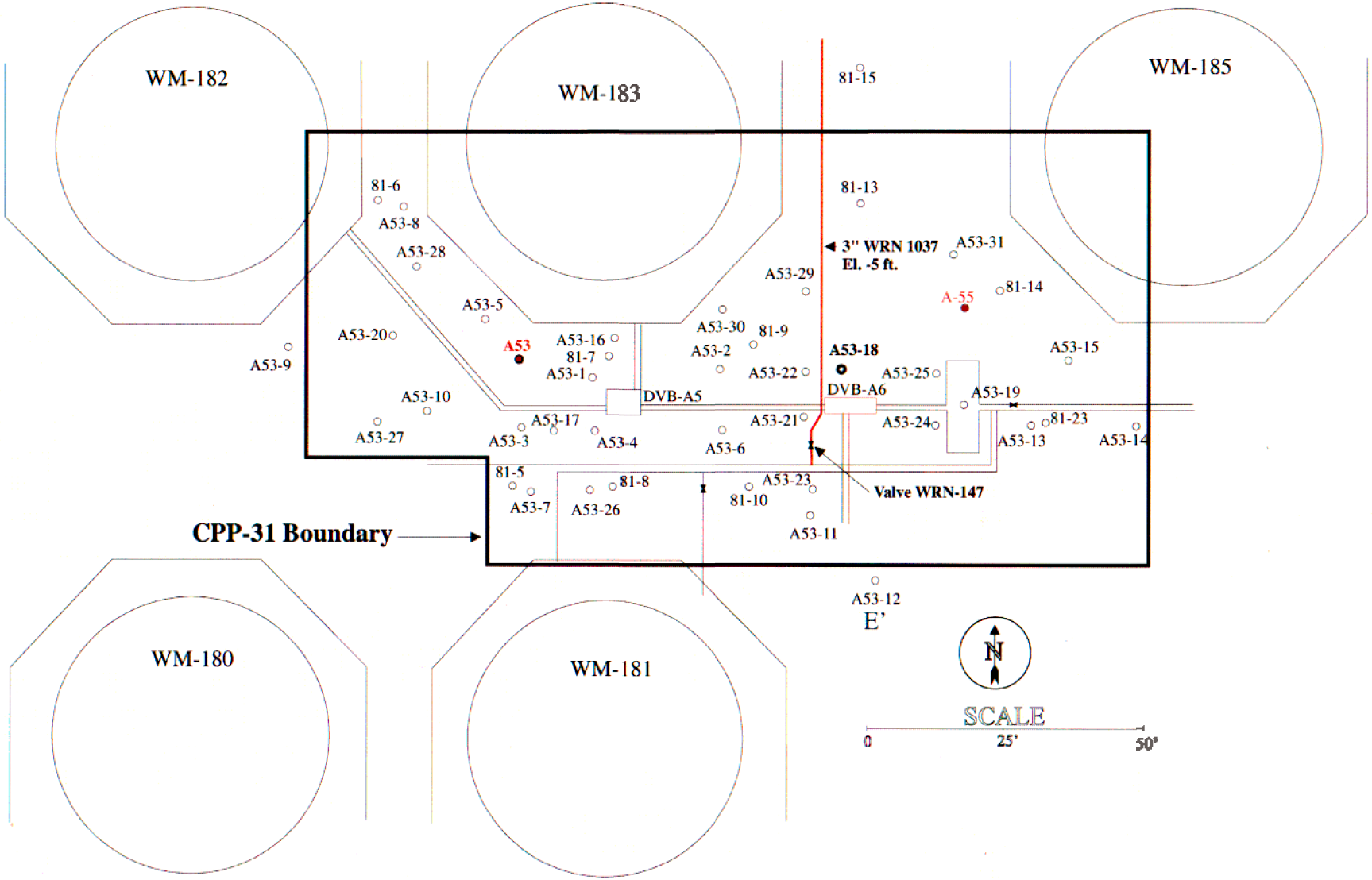

Figure 3-3. CPP-31 release site boundary and locations of monitoring wells and soil probes in and around the release site.

November and December 7, 1975, to help pinpoint the source of contamination and further characterize the lateral and vertical extent. Location A-53-18, just north of valve box A-6, was unique in that radiation between 1.3–3.4 R/hr was measured at 4, 9, and 10 ft bgs. This suggested that the leak might have originated from a point above the elevation of the main waste lines located in the concrete encasements.

Late in November 1975, a potential leak mechanism was identified during the process of reviewing design criteria for the Liquid Waste Improvement Project. One of the tasks to be completed during the project was to disconnect and abandon a carbon-steel line (3"WRN1037) having no secondary containment, which connected to the stainless-steel pipe-within-a-pipe intermediate waste-transfer line (3"PWA1014). The transition from carbon steel to stainless steel occurred at a point located just southwest of valve box A-6 at a depth of approximately 5 ft bgs (Figure 3-4). A stainless-steel valve (WRV-147) located in the line about 6 ft north of the point of connection provided isolation between

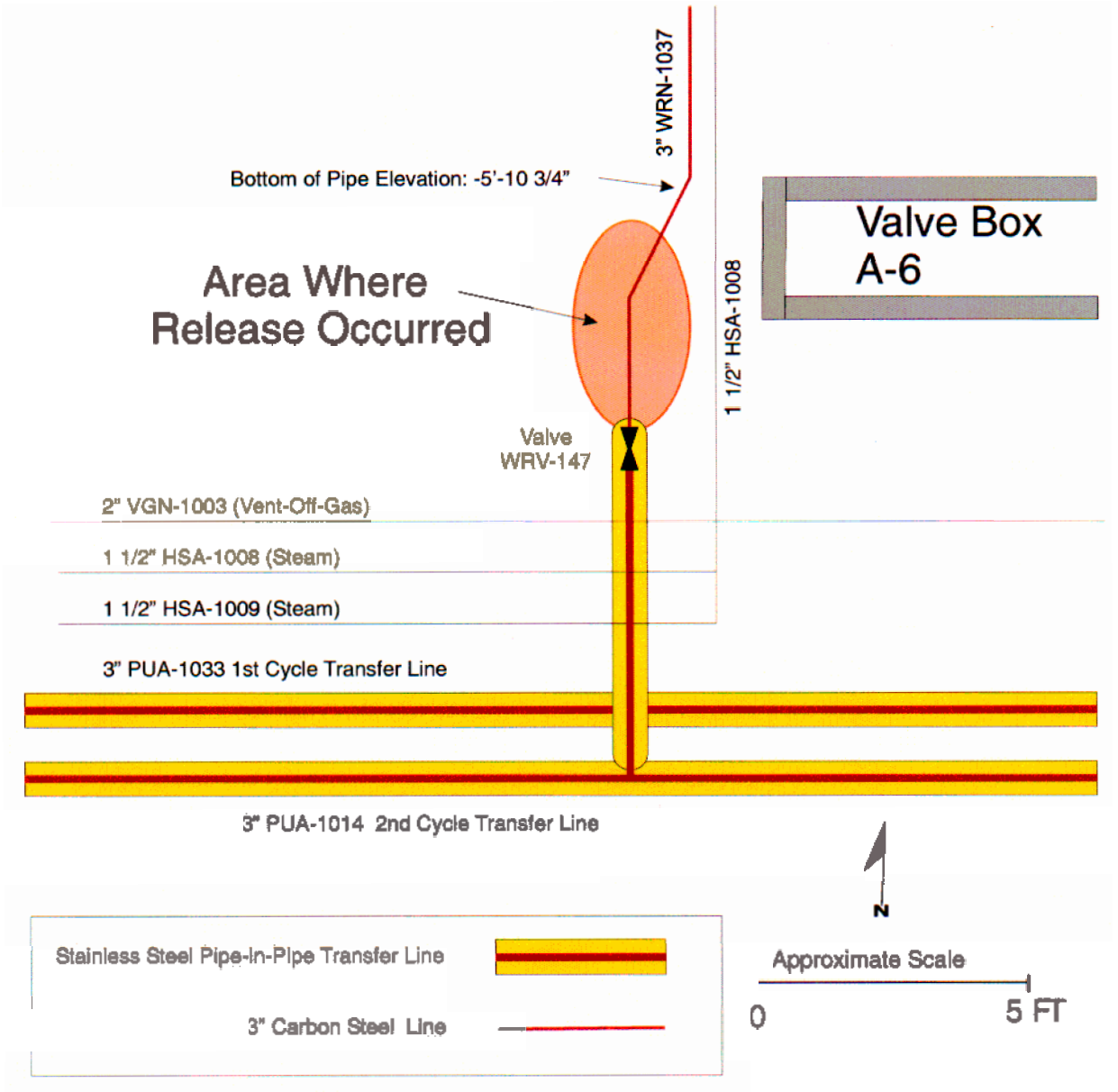

Figure 3-4. Plan view of the piping configuration at the CPP-31 release site.

the two lines. The 3"WRN1037 carbon-steel line, originating in building CPP-628, was originally plumbed into the waste-handling system as a means of discarding cooling water circulating in a closed-loop system in the event that it became contaminated due to a tank cooling coil leak. The line, which was disconnected and blinded off in building CPP-628, was pressure-tested against the closed valve. The line failed to hold pressure. It was presumed that the carbon-steel line came into contact with waste that was highly corrosive to carbon steel.

On December 11, 1975, the junction of 3"WRN1037 and 3"PWA1014 was uncovered, and on December 16, 1975, the stainless-steel line and encased portions of drain line were cut and capped. Pressure tests were applied to both the stainless-steel portion of the abandoned line to determine whether valve WRV-147 could have leaked in the closed position and the intermediate waste-transfer line 3"PWA1014. Both tests maintained pressure, demonstrating that those lines were not leaking. No further field work was conducted, and the investigation concluded that valve WRV-147 was open or partially open during one major liquid waste transfer in November 1972, when the contents of WM-181 (PEW bottoms and second- and third-cycle waste) were transferred to WM-180. The records show that about 271,000 gal of waste was transferred from WM-181, and approximately 265,000 gal were received in WM-180; this is 6,000 gal less than was sent. Taking jet dilution into account, the volume reaching WM-180 should have been about 8,000 gal greater than was transferred out of WM-181, resulting in approximately 14,000 gal backing through valve WRV-147 to the corroded carbon-steel line and into the soil.

3.1.1.1 Extent of Soil Contamination at CPP-31. Following the installation of boreholes and observation wells, direct readings were obtained from the subsurface by lowering a string of thermoluminescent dosimeter chips down the cased hole or drill rod, exposing the chips for 1 hr. The results of these measurements taken in 1975 are presented in Table 3-2. The vertical contaminant distribution in some of the boreholes was believed to be somewhat distorted due to the auger drill used. Activity near the top of the holes was considered to be primarily activity augered up from the main pocket of activity at a depth of 12 to 25 ft. Likewise, higher levels of activity at the bottom of the hole were considered to be the result of drill bit contamination and contaminated soil falling into the hole from the highly contaminated horizons above. The data presented were used to develop a map depicting the lateral extent of contaminated soil (Figure 3-5). Six fence diagrams (Figures 3-6 through 3-11) show the vertical contaminant distribution along various transects through the contaminated zone. The contaminant distribution appears to be associated with zones of preferential movement in the horizontal direction, mainly along waste-transfer lines 3"PWA-601/602 connecting valve boxes A-5 and A-6 to WM-182 and waste-transfer lines 3"PWA-609/610 buried approximately 11 to 12 ft bgs.

In the early 1980s, several additional monitoring wells, designated the "81 series," were installed in the tank farm area near CPP-31 (Figure 3-3). As a part of the 1992 OU-3-07 Track 2 investigation (WINCO 1993a), radiation profile surveys were performed on 10 existing wells, including eight of the 81 series wells. Results of the 1992 surveys are presented in Table 3-3. A comparison of those results to previous subsurface radiation profile measurements is inconclusive as to whether migration has occurred since the time of release or if the radiation levels in the soil were increasing or decreasing over time.

Based on the number of monitoring wells installed and their associated radiation profiles, the lateral and vertical extent of the contaminated soil appears to be adequately bounded, with the exception of a small area east of valve box A-6 along the piping runs of 3"PWA-1005 and 3"PWA-1030. Monitoring well A53-25 encountered contaminated soil but did not penetrate the vertical extent of contamination at that location. However, based on reviews of data from other probes, the contamination likely extends no deeper than 25 ft bgs, leaving approximately 15 ft of alluvial material between the bottom of the measured contamination and the top of the basalt.

Table 3-2. Direct radiation measurements in 1975 from boreholes or observation wells installed at Site CPP-31 after the release.

Depth (ft)	Borehole or Observation Well (all measurements in R/hr)															
	A53	A53-1	A53-2	A53-3	A53-4	A53-5	A53-6	A53-7	A53-8	A53-9	A53-10	A53-11	A53-12	A53-13	A53-14	A53-15
1	1.0	1.0	0.3	0.5	0.2	0.015	0.4	0.02	0.01	0.01	1.0	0.01	0.01	0.3	0.007	0.55
2	—	—	—	0.6	0.2	0.01	0.35	0.01	0.01	—	1.5	—	—	—	—	0.61
3	—	—	—	0.65	0.35	0.04	0.4	0.01	—	—	1.5	—	—	—	—	0.45
4	—	—	—	0.6	0.4	0.07	0.4	0.01	—	—	1.5	—	—	—	—	0.5
5	1.5	2.0	0.25	0.6	0.5	0.2	0.45	0.05	0.01	0.01	1.5	0.085	0.02	0.5	0.003	0.5
6	—	—	—	—	1.0	0.5	0.5	0.02	—	—	1.5	—	—	—	—	0.6
7	—	—	—	0.65	1.3	1.6	0.55	0.02	—	—	1.5	—	—	—	—	0.35
8	—	2.0	—	0.6	1.0	2.5	0.55	0.01	—	—	1.5	—	—	—	—	0.3
9	—	3.0	—	0.6	1.8	4.0	0.55	0.01	—	—	1.5	—	—	—	—	0.2
10	2.0	2.5	0.45	0.5	1.1	3.5	0.7	0.01	0.005	0.01	1.5	0.01	0.015	0.55	0.005	0.2
11	—	3.0	0.5	0.6	2.0	4.0	0.8	0.01	—	—	—	—	—	—	—	0.2
12	—	3.0	1.5	0.6	2.5	5.0	0.9	0.01	—	—	2.0	—	—	—	—	0.2
13	2.0	>10.0	>10.0	2.0	4.0	5.0	>10.0	0.01	—	—	2.0	—	—	—	—	0.15
14	>10.0	8.0	1.5	7.0	3.5	7.0	>10.0	0.005	—	—	>10.0	—	—	0.9	0.01	0.2
15	3.0	1.5	0.1	0.6	2.0	4.5	0.35	0.006	0.005	0.0032	>10.0	0.005	0.01	3.0	0.005	0.3
16	3.0	2.0	—	0.45	3.0	5.5	0.1	0.004	—	—	4.0	—	—	0.5	0.006	5.0
17	10.0	>10.0	—	0.85	8.5	9.0	0.1	0.003	—	—	2.0	—	—	0.5	—	4.0
18	>10.0	>10.0	—	9.0	>10.0	>10.0	0.1	0.002	—	—	10.0	—	—	—	—	0.2
19	>10.0	5.0	—	1.4	3.0	>10.0	0.05	0.003	—	—	0.6	—	—	—	—	0.1
20	2.5	0.2	0.01	1.1	2.5	8.5	0.05	0.008	0.003	0.006	0.35	0.006	0.006	0.035	0.003	0.05
21	2.5	—	—	—	0.7	10.0	0.05	0.004	—	—	0.20	—	—	—	—	0.01
22	5.0	—	—	—	—	6.0	0.02	0.004	—	—	0.10	—	—	—	—	0.01
23	>10.0	—	—	0.15	—	1.0	0.025	0.005	—	—	0.10	—	—	—	—	0.01
24	6.0	—	—	—	—	0.15	0.03	0.01	—	—	0.1	—	—	0.015	—	0.01
25	0.3	0.2	0.08	0.25	2.0	1.0	0.04									

Table 3-2. (continued).

Depth (ft)	Borehole or Observation Well (all measurements in R/hr) (continued)															
	A53-16	A53-17	A53-18	A53-19	A53-20	A53-21	A53-22	A53-23	A53-24	A53-25	A53-26	A53-27	A53-28	A53-29	A53-30	A53-31
1	<0.001	<0.001	<0.001	<0.001	<0.001	—	—	Bkg	0.02	Bkg	0.02	0.015	Bkg	Bkg	—	Bkg
2	<0.001	<0.001	<0.001	<0.001	<0.001	1.0	0.05	Bkg	4.06	0.04	0.02	Bkg	Bkg	Bkg	—	Bkg
3	<0.001	<0.001	0.02	<0.001	<0.001	9.8	0.06	Bkg	Bkg	0.03	0.03	0.02	Bkg	0.035	Bkg	Bkg
4	<0.001	<0.001	1.3	<0.001	<0.001	23.7	1.79	Bkg	3.9	0.18	Bkg	Bkg	Bkg	2.03	Bkg	Bkg
5	<0.001	<0.001	0.1	<0.001	<0.001	41.8	6.29	Bkg	Bkg	0.03	Bkg	Bkg	Bkg	Bkg	Bkg	Bkg
6	<0.001	<0.001	0.1	<0.001	<0.001	50.2	3.13	Bkg	0.02	0.04	0.02	0.04	Bkg	0.03	0.01	Bkg
7	<0.001	<0.001	0.1	<0.001	<0.001	49.2	0.38	Bkg	0.02	0.02	0.03	Bkg	Bkg	Bkg	0.06	Bkg
8	<0.001	<0.001	0.2	<0.001	<0.001	46.1	0.13	Bkg	0.01	0.04	0.03	Bkg	Bkg	0.2	0.01	Bkg
9	<0.001	<0.001	3.4	0.002	<0.001	49.2	0.18	Bkg	0.06	0.04	Pipe Broken In Coupling	Bkg	Bkg	7.5	Bkg	Bkg
10	<0.001	0.002	2.8	0.005	<0.001	40.0	—	Bkg	0.02	0.19		Bkg	Bkg	1.6	Bkg	Bkg
11	<0.001	0.006	0.34	0.1	<0.001	24.8	—	Bkg	0.03	0.47		Bkg	Bkg	0.2	0.08	Bkg
12	0.03	0.04	0.27	0.15	0.004	27.8	—	Bkg	0.26	2.0		Bkg	Bkg	4.0	0.60	Bkg
13	1.1	1.78	3.1	1.9	0.22	27.3	—	Bkg	4.9	2.6		Bkg	Bkg	1.5	0.10	Bkg
14	11.6	8.2	8.8	16.0	7.3	26.9	—	Bkg	14.9	33.9		6.6	Bkg	—	0.04	Bkg
15	15.1	15.2	1.76	28.0	9.08	22.6	—	Bkg	16.2	40.1		—	Bkg	—	—	Bkg
16	2.4	23.5	5.4	23.0	6.8	10.3	—	Bkg	20.2	43.2		—	0.07	—	—	Bkg
17	1.9	6.8	0.25	13.0	16.4	12.3	—	Bkg	3.8	34.5		—	0.8	—	—	Bkg
18	8.6	19.9	0.04	3.4	1.57	1.16	—	Bkg	1.6	36.6		—	5.8	—	—	Bkg
19	12.6	2.1	0.03	2.3	0.16	0.61	—	Bkg	1.6	—		—	—	—	—	Bkg
20	0.6	3.3	0.04	4.0	0.7	—	—	Bkg	—	—		—	—	—	—	Bkg

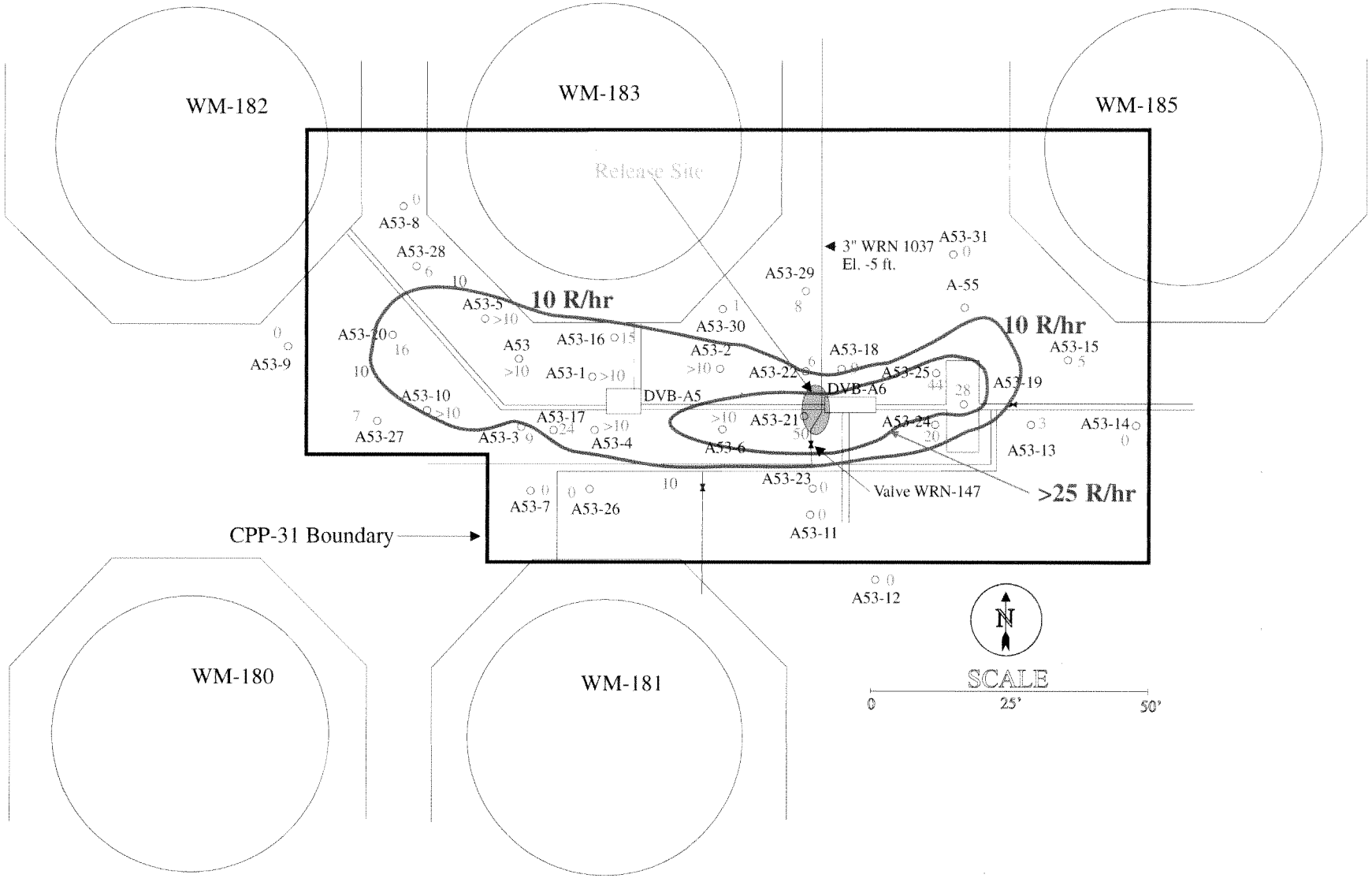

Figure 3-5. Extent of lateral contamination at the CPP-31 release site (measurements in R/hr).

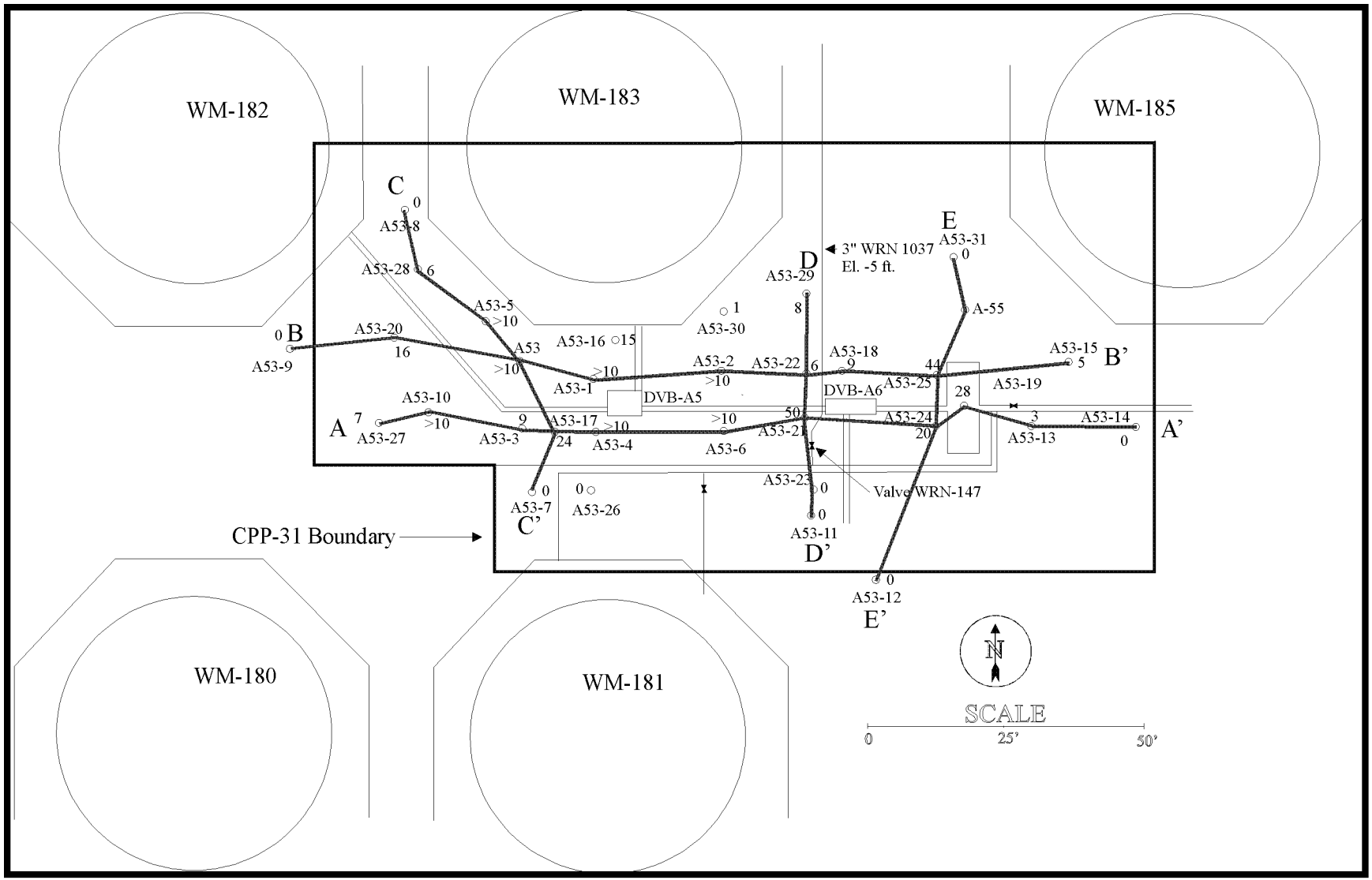

Figure 3-6. Fence diagram showing vertical and lateral extent of soil contamination (measurements in R/hr) at CPP-31.

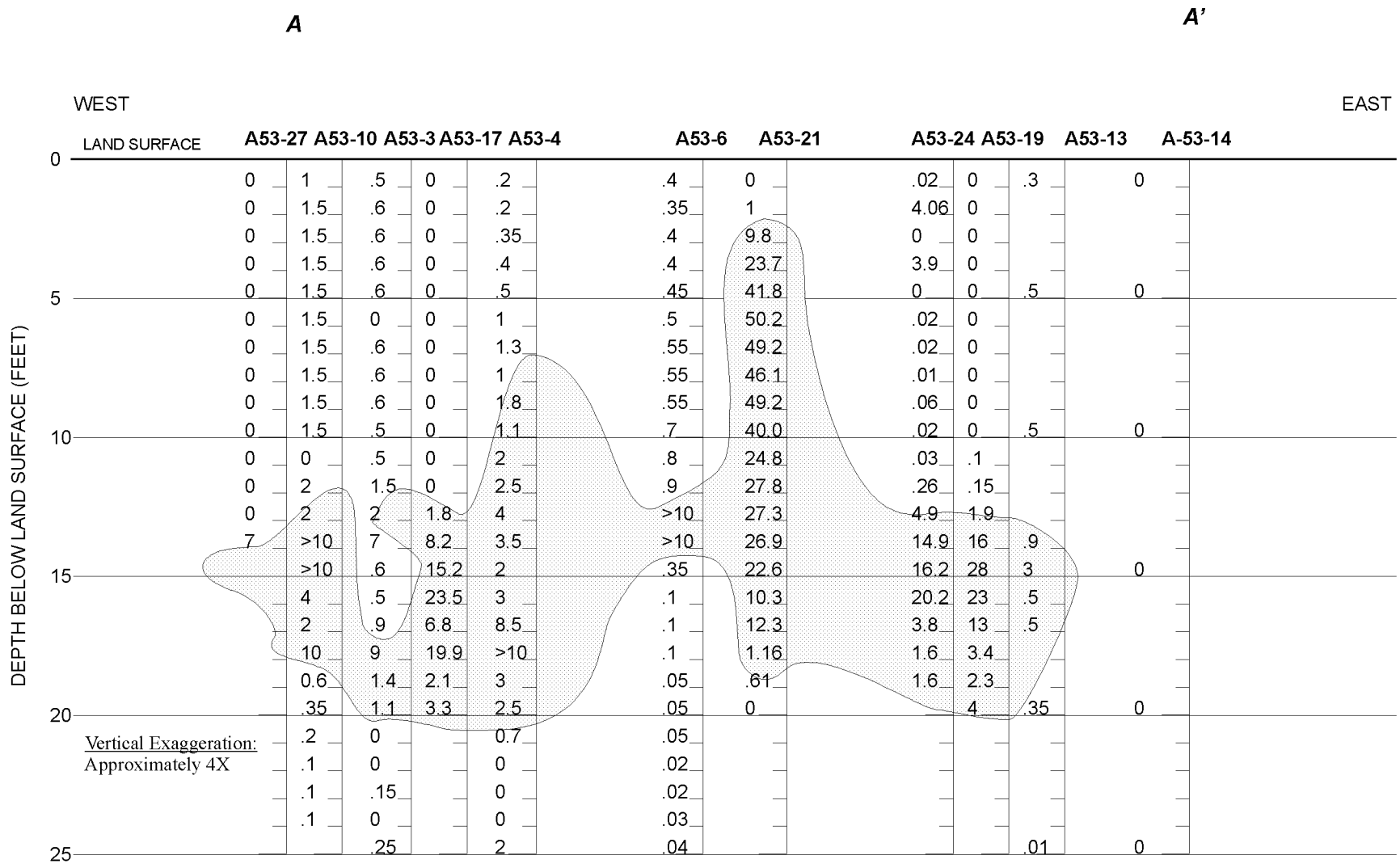

Figure 3-7. East-to-west, A-to-A', fence diagram through the CPP-31 zone of contamination (radiation readings are in R/hr; readings >5 R/hr are shown in red).

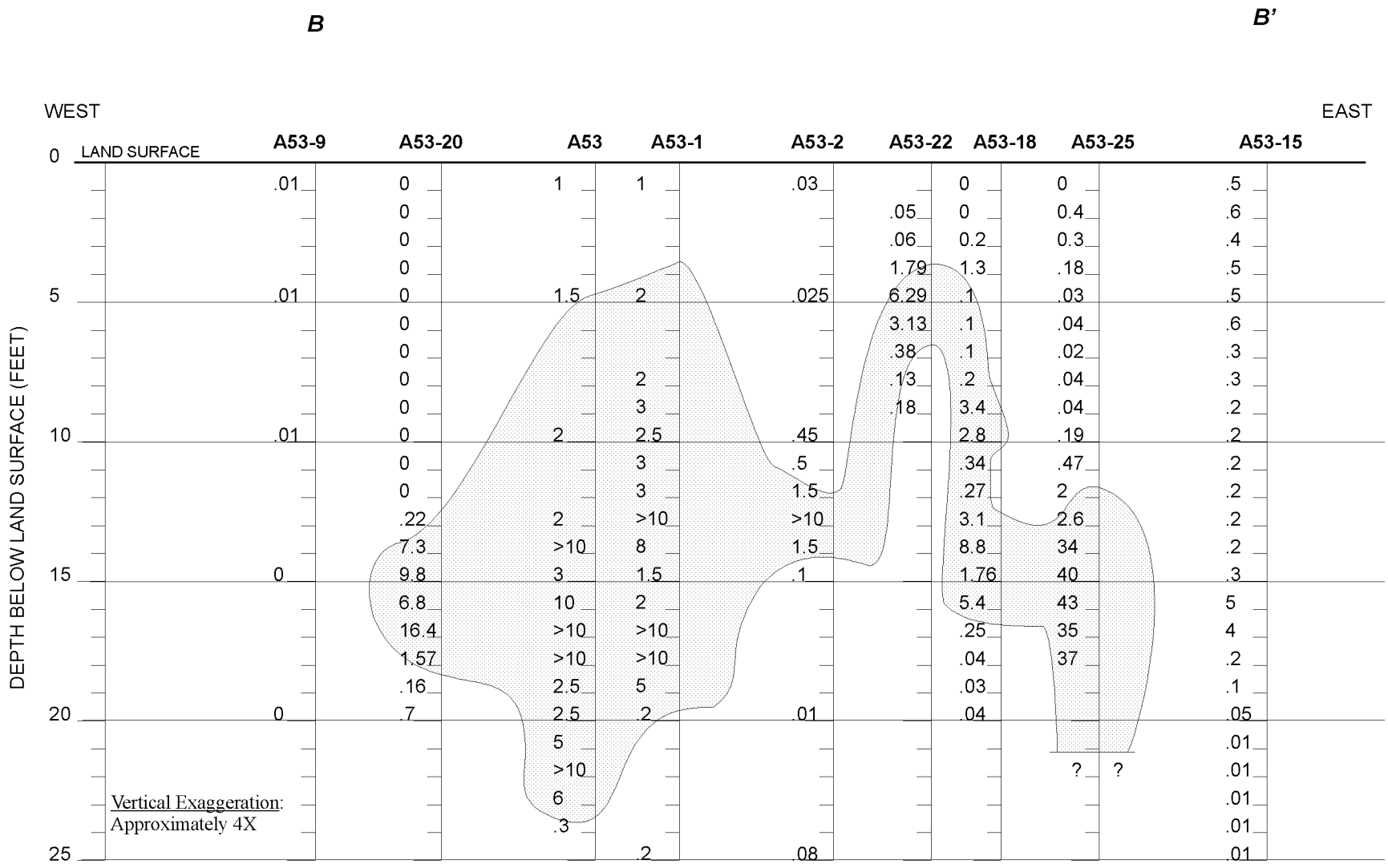

Figure 3-8. West-to-east, B-to-B', fence diagram through the CPP-31 zone of contamination (radiation readings are in R/hr; readings >5 R/hr are shown in red).

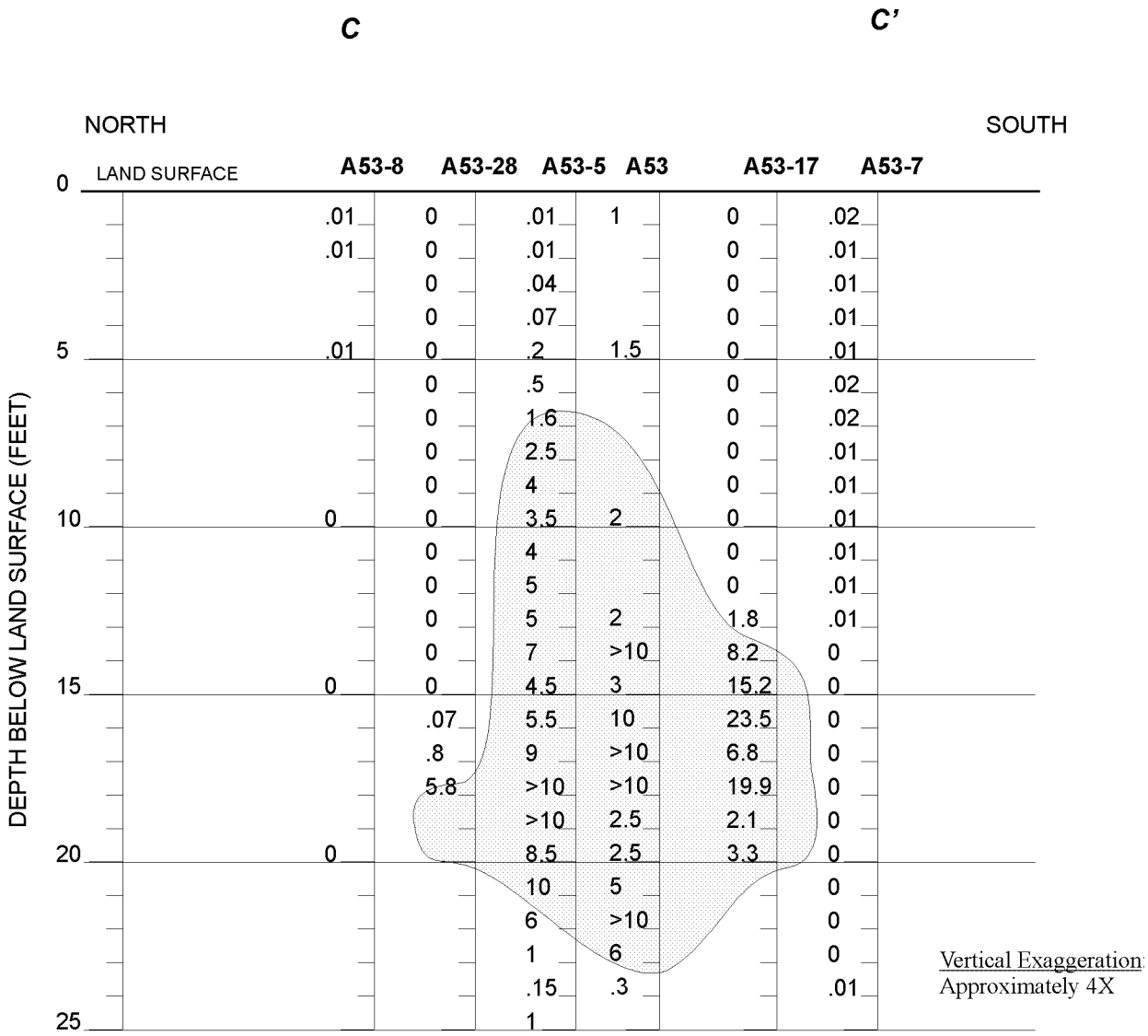

Figure 3-9. North-to-south, C-to-C', fence diagram through the body of contaminated soil at CPP- 31 (radiation readings are in R/hr; readings >5 R/hr are shown in red).

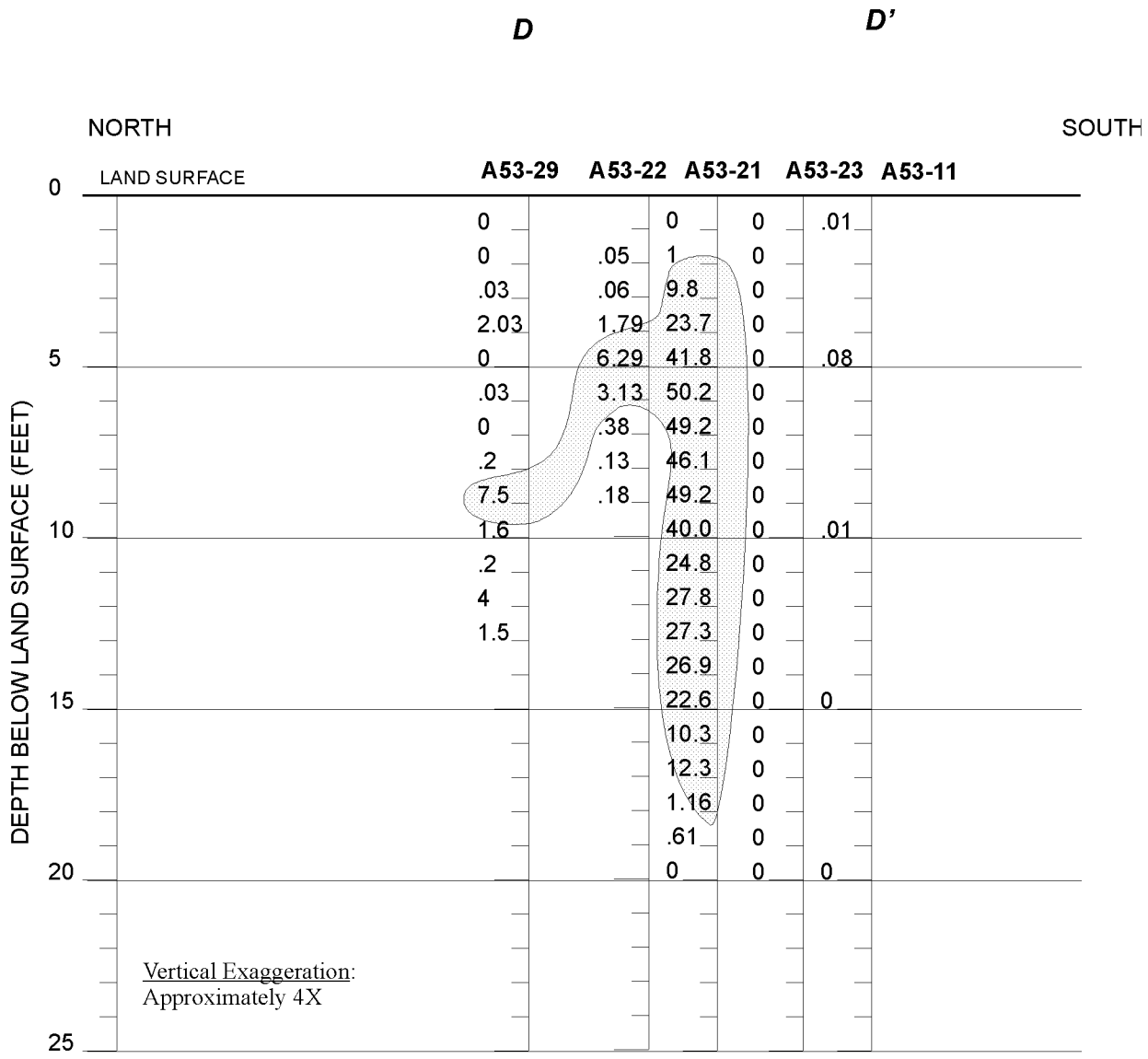

Figure 3-10. North-to-south, D-to-D', fence diagram through the body of contaminated soil at CPP-31 (radiation readings are in R/hr; readings >5 R/hr are shown in red).

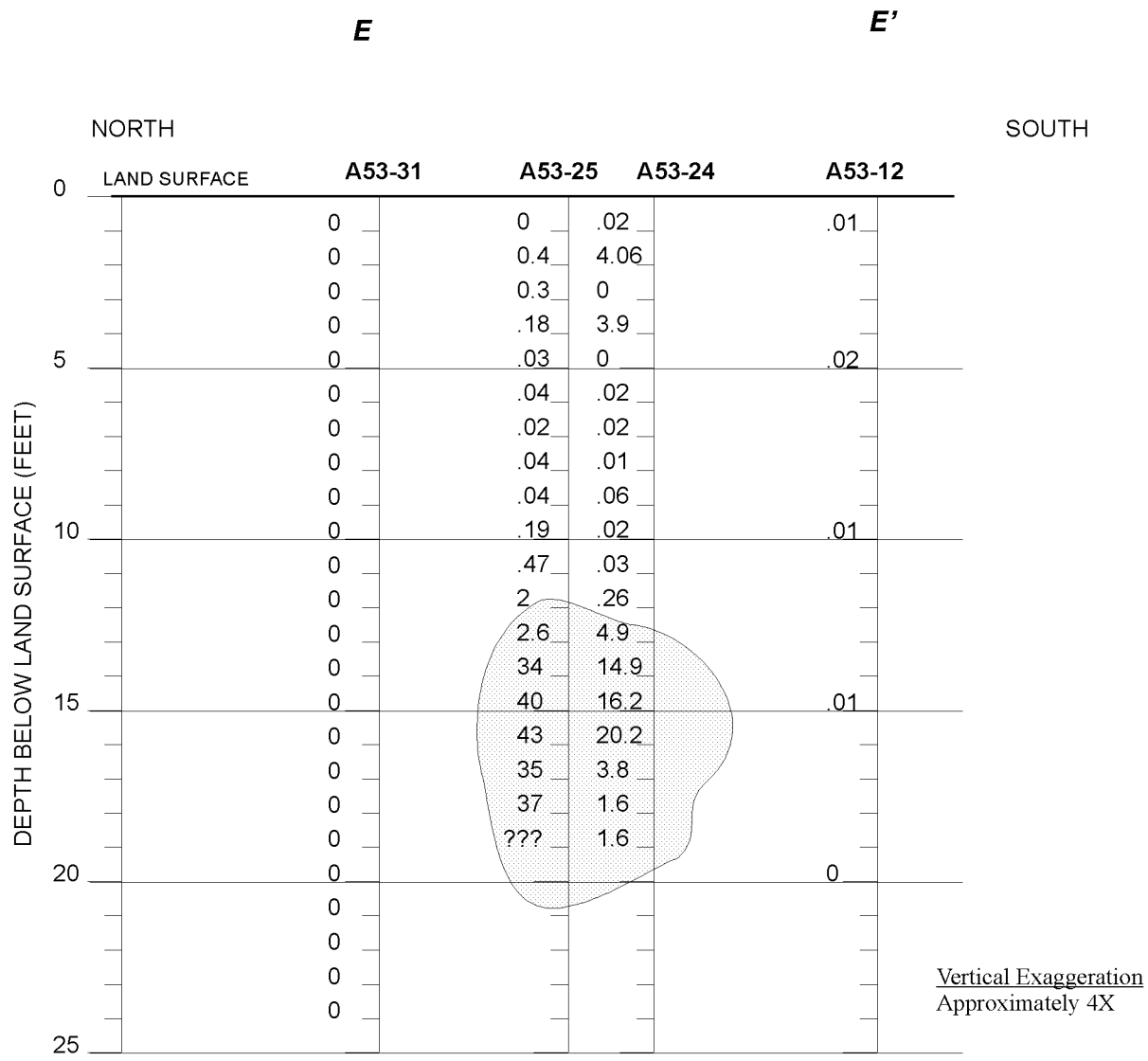

Figure 3-11. North-to-south, E-to-E', fence diagram through the body of contaminated soil at CPP-31 (radiation readings are in R/hr; readings >5 R/hr are shown in red).

Table 3-3. Summary of the subsurface radiation profile performed on selected probes at site CPP-31 on August 18, 1992.

Depth (ft)	Exposure Rate in R/hr									
	A53-11	A53-19	81-3	81-6	81-7	81-8	81-9	81-10	81-13	81-14
2	0.1	0.1	0	0.1	0.1	0.1	0.1	0	0.1	0
4	0.1	0.1	0	0.1	0.1	0.1	0.1	0	0.1	0.1
6	0.1	0.1	0	0.1	0.1	0.1	0.1	0	0	0.1
8	0.1	0.1	0	0.1	0.1	0.1	0.1	0	0.2	0
10	0.2	0.1	0	0.1	0.1	0	0.1	0	7.4	0.1
12	0.1	0.1	0	0.1	0.1	0.1	1.2	0	0.2	0.1
14	0.1	0.2	0	0.1	0.1	0.1	0.2	0	0.1	0.1
16	0.1	13.1	0	0.1	0.3	0.1	1.1	0	0.1	0.1
18	0.1	22.3	0.5	0.1	0.6	0	0.1	0	0.1	9.3
20	0.1	9.0	0.1	0.1	0.1	0.1	0.1	0	0.1	0.1
22	0.1		Note: >0.2 @ 19 ft	0.1	8.4	0.1	0.1	0		0.1
24	0.1			0.1	8.8	0.1	0	0		0.1
26				0.1	Note: >2.0 @ 23 ft	0.1	0.1	0		0
28				0.1			0.1	0		0
30				0.2						0
				Note: >1.5 @ 29 ft						

3.1.1.2 Volume of Contaminated Soil and Associated Activity at CPP-31. The volume of soil with contact radiation levels exceeding 1 R/hr was estimated to be 800 yd^3, and a calculated gross activity of 2 to 3 $\times$ 10^4 Ci was determined from the field data. However, a more accurate source term for the CPP-31 release can be determined using process knowledge and WM-181 tank sampling results from September 1972. The 1972 sample results of the liquid in WM-181, consisting of second- and third-cycle waste along with evaporator bottoms, indicated that in 1972, the Cs-137 and Sr-90 curie content would be 1.7 Ci/gal. Multiplying the estimated 14,000-gal loss by the curie content per gallon results in a 23,800-Ci release.

3.1.2 Site CPP-28

The contamination at site CPP-28 resulted from an inadvertent penetration of a waste-transfer line during construction, resulting in release of first-cycle waste over a period of about 18 years. The release and its investigation are described chronologically below.

On October 1, 1974, during the course of drilling operations in connection with an upgrade construction project for the INTEC cathodic protection system, contaminated soil was encountered at a location point identified as anode 1-42 (Figure 3-12). The hole being drilled for an anode encountered contaminated soil with contact radiation levels of 1 R/hr at 6 ft bgs; this hole is located 10 ft south of the concrete vault that houses liquid waste storage tank WM-181 and approximately 5 ft north of waste-transfer line 3"PWA-1005 used to transfer first-cycle raffinates. The borehole was advanced on October 2, 1974, to a depth of 10 ft, and soil samples were collected for analysis. Results of the sample

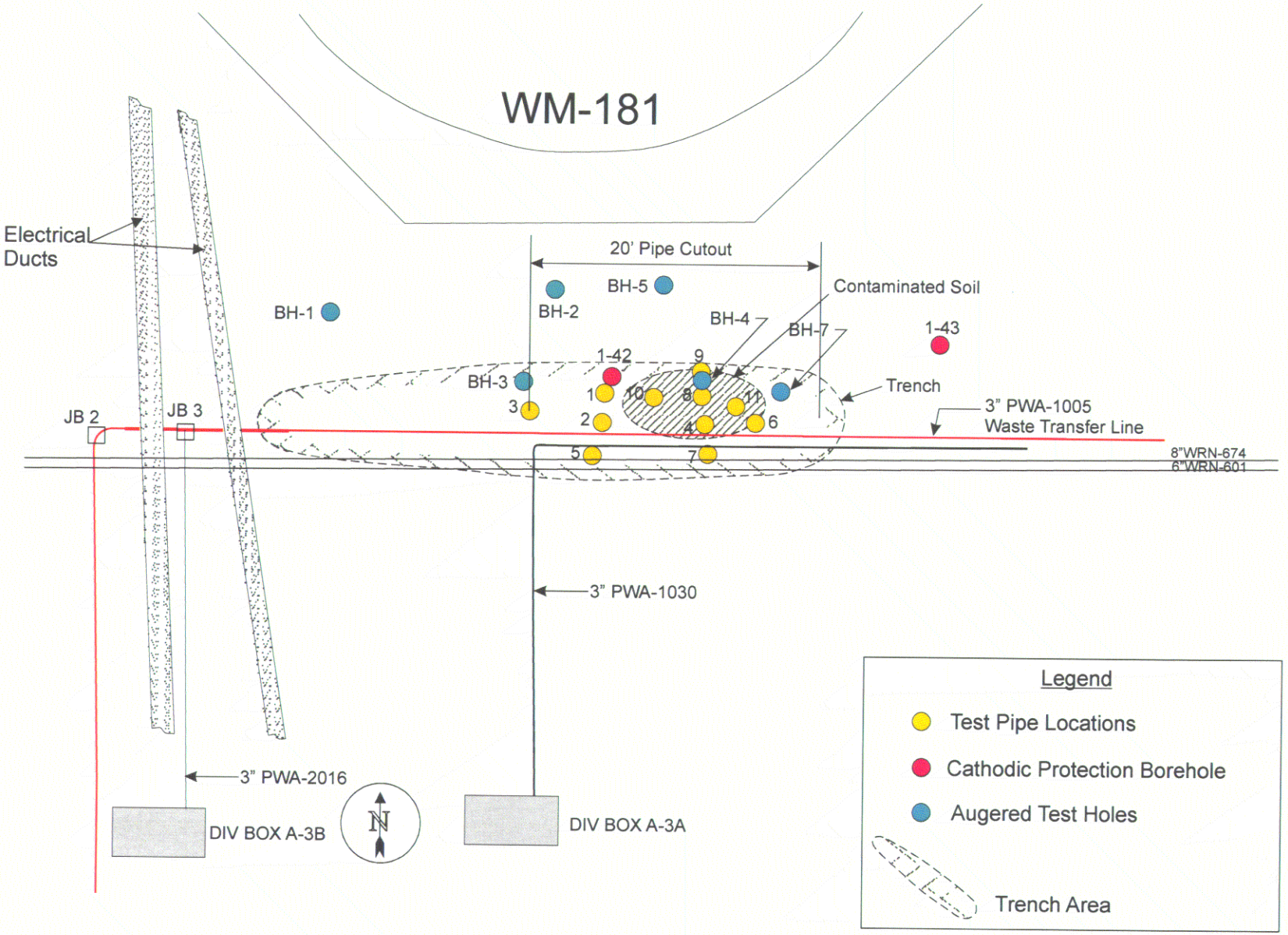

Figure 3-12. CPP-28 trenching investigation location map.

analysis indicated Cs-137, Ru-106, Ce-144, and Sr-90 were the primary isotopes. Unfortunately, analytical data sheets for these samples could not be located to provide actual radionuclide activities or the suite of analytes tested for.

To help determine the nature and extent of contaminated soil, six soil borings were drilled on October 10, 1974. Soil samples were collected from the bottom of each hole, ranging in depth from 6.5 to 10 ft bgs. The boreholes are designated as BH-1 through -5 and BH-7. Contamination was encountered in only one of the six holes drilled (Figure 3-11). Hole #4 encountered contaminated soil readings of up to 35 R/hr beta-gamma at contact. No isotopic analyses were performed on any of the soil samples. On the basis of the beta-gamma readings, some type of waste release was believed to have occurred.

On October 17, 1974, a review team was appointed by Allied Chemical, Idaho Chemical Programs Operations Office Management, to evaluate the consequence, determine the release mechanism, and define the extent of the contaminated soil body. In order to accomplish its primary mission, the review team initiated immediate trenching operations to permit inspection of the 3"PWA-1005 waste-transfer line in the area of soil contamination, permit inspection of diversion valve boxes A-3A and A-3B, and plan for the installation of additional soil borings to determine the extent of soil contamination.

Trenching operations were started on October 22, 1974, beginning at the intersection of an underground electrical duct near junction box No. 3, approximately 25 ft west of anode 1-42, and working eastward directly above line 3"PWA-1005 (Figure 3-11). A lap joint in the encasement was uncovered and inspected approximately 10 ft west of anode 1-42. This inspection revealed a 1.5-in. separation at the lap joint and a longitudinal joint separation of several feet where the tapping screws had corroded. The inside of the encasement in the region of joint separation was partially filled with soil. At that point in the investigation, several holes were hand-augered to depths of 3 ft below the encasement with no indication of soil contamination.

Contaminated soil was first encountered during the trenching operations approximately 3 ft west of anode 1-42. This soil was believed to have been brought up during the augering of the exploratory test holes. Trenching continued eastward approximately 10 ft past the zone of contamination. A second encasement lap joint was encountered approximately due south of anode 1-42. Inspection of the joint revealed a greater degree of deterioration than with the first joint uncovered. A section of the upper carbon-steel cover approximately 1 ft long appeared to be severely corroded (presumably from contact with an acidic waste solution) and had some inward collapse.

During excavation activities, clean soil was stockpiled while contaminated soil was loaded into special containers for disposal at the RWMC. Soil with radiation readings up to 75 R/hr gross beta-gamma was encountered at depths less than 2 ft beneath the encasement. Efforts to excavate to depths below the encasement in the central zone of contaminated soil were abandoned because of handling and exposure problems. A total of 56 yd^3 of contaminated soil containing an estimated 3,000 Ci of gross radionuclides was removed from the release site. Samples taken from the contaminated soil had the following distribution of radionuclides (by activity): 0.2% Mn-54, 0.5% Co-60, 3.2% Ru/Rh-106, 1.4% Cs-134, 12.2% Cs-137, 21.4% Ce-144, 1.3% Eu-154, 0.8% Eu-155, and 59% Sr/Y-90 (Allied Chemical 1974). No other sample data were provided in the Allied Chemical contaminated soil report. A summary of excavations performed for this and other tank farm sites is presented in Section 3.1.14.2.

After trenching operations were completed, monitoring test pipes were driven into the ground using a cable crane rig outfitted with a 750-lb drive shoe (Figure 3-13). Test pipes were driven in 11 locations adjacent to the pipeline encasement and in the area of soil contamination to depths up to 20 ft, as shown in Figure 3-12. After each test pipe was driven, a radiation-detection probe was lowered into the test pipe, and radiation readings were measured at specific depth intervals. Recorded radiation readings collected from the test pipes are presented in Table 3-4.

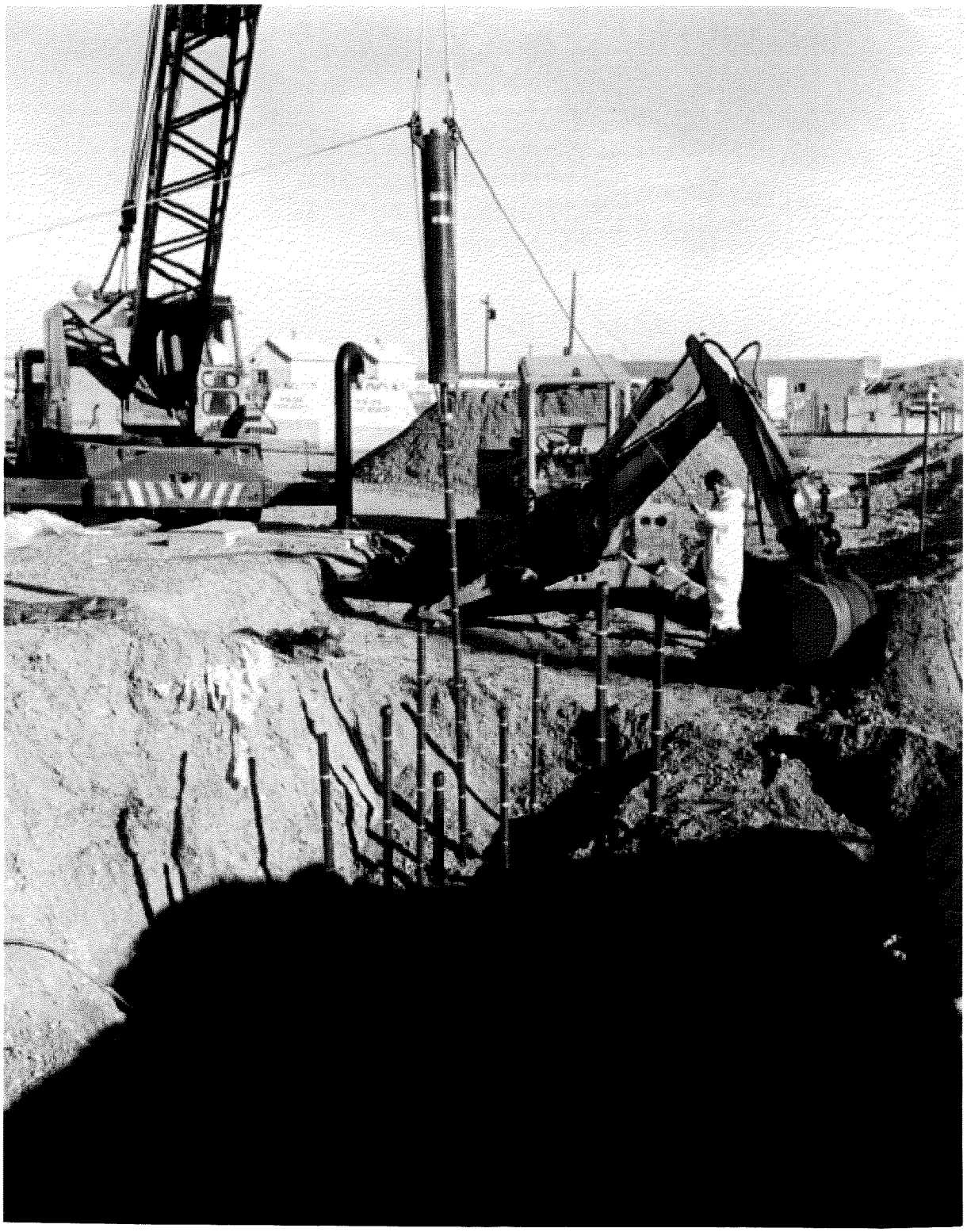

Figure 3-13. Test pipes being driven into the ground during the contaminant release investigation in 1974 at CPP-28.

Table 3-4. 1974 test hole radiation readings for CPP-28 (R/hr).[a, b, c]

Depth	Test Hole #1	Test Hole #2	Test Hole #3	Test Hole #4	Test Hole #5	Test Hole #6	Test Hole #7	Test Hole #8	Test Hole #9	Test Hole #10	Test Hole #11
0.0	—	—	—	—	0.030	—	—	—	—	—	—
1.0	0.035	—	—	—	0.030	0.025	0.020	0.040	0.010	0.040	0.040
2.0	0.035	0.050	0.025	0.060	0.050	0.030	0.015	0.050	0.040	0.040	0.040
3.0	0.035	0.050	0.025	0.070	0.060	0.035	0.006	0.070	0.040	0.040	0.050
4.0	0.035	0.050	0.025	0.100	0.060	0.070	0.002	0.080	0.040	0.050	0.060
5.0	0.030	0.050	0.025	0.150	0.070	0.200	0.003	0.100	0.040	0.060	0.050
6.0	0.007	0.200	0.018	0.200	0.060	0.250	0.010	0.350	0.012	0.090	0.150
6.5	—	—	—	**1.50**	—	—	—	**2.00**	—	—	—
7.0	0.007	1.500	0.003	**5.50**	0.100	0.150	0.010	**7.00**	0.008	0.350	**5.00**
7.5	—	—	—	**35.00**	—	—	—	**12.00**	—	—	—
8.0	0.007	0.300	0.002	**20.00**	**2.00**	0.040	0.010	**90.00**	0.008	**11.00**	**11.00**
8.5	—	—	—	**3.00**	—	—	—	**65.00**	—	**50.00**	—
9.0	0.050	0.060	0.001	0.800	0.050	0.020	0.050	**10.00**	0.006	**4.00**	0.250
9.5	—	—	—	—	—	—	—	**1.00**	—	—	—
10.0	0.040	0.005	0.0006	0.100	0.020	0.004	0.250	0.012	—	0.050	0.010
11.0	0.020	0.005	0.0005	0.010	0.050	0.001	0.050	0.004	<0.005	0.007	0.002
12.0	0.010	0.0015	<0.0005	0.006	0.050	<0.001	0.012	0.002	—	0.001	<0.001
13.0	0.010	0.001		0.003	0.060			0.001	<0.001	<0.001	
14.0		<0.0005		0.002	0.002			<0.001			
15.0				0.001	0.001						

a. — indicates radiation level was not measured.
b. Values in bold red indicate radiation levels equal to, or greater than, 1.0 R/hr.
c. Shading indicates the elevation of the waste-transfer line 3" PWA-0=1005.

On December 3, 1974, work began to cut, remove, and inspect the 20-ft section of the waste-transfer line to determine the cause of the contamination. After removal of the pipe section, a cursory inspection revealed a 1/8-in.-diameter drill hole in the side of the 3-in. stainless-steel pipe (Figure 3-14). After closer inspection, the hole in the pipe was determined to be 10 ft, 7 in. from the east pipe cut and oriented 90° from the top of the pipe on the south side as originally installed. This location corresponded closely with the location of the corroded area of the upper section of carbon-steel encasement observed in the field. The hole penetrated completely through the pipe wall, and small indents 40 to 50 mils deep existed along the pipe on 1-ft centers eastward from the hole. No holes or indents were found on the opposite (north) side of the pipe. The hole and indents were consistent with the stitch screw spacing used to hold the top cover of the encasement to the bottom trough. A metallurgical inspection indicated that the pipe suffered very little corrosion damage during its 18 years of intermittent service and that the failure was strictly due to a hole that had existed when it was inadvertently drilled into the waste line during construction from 1955 to 1956.

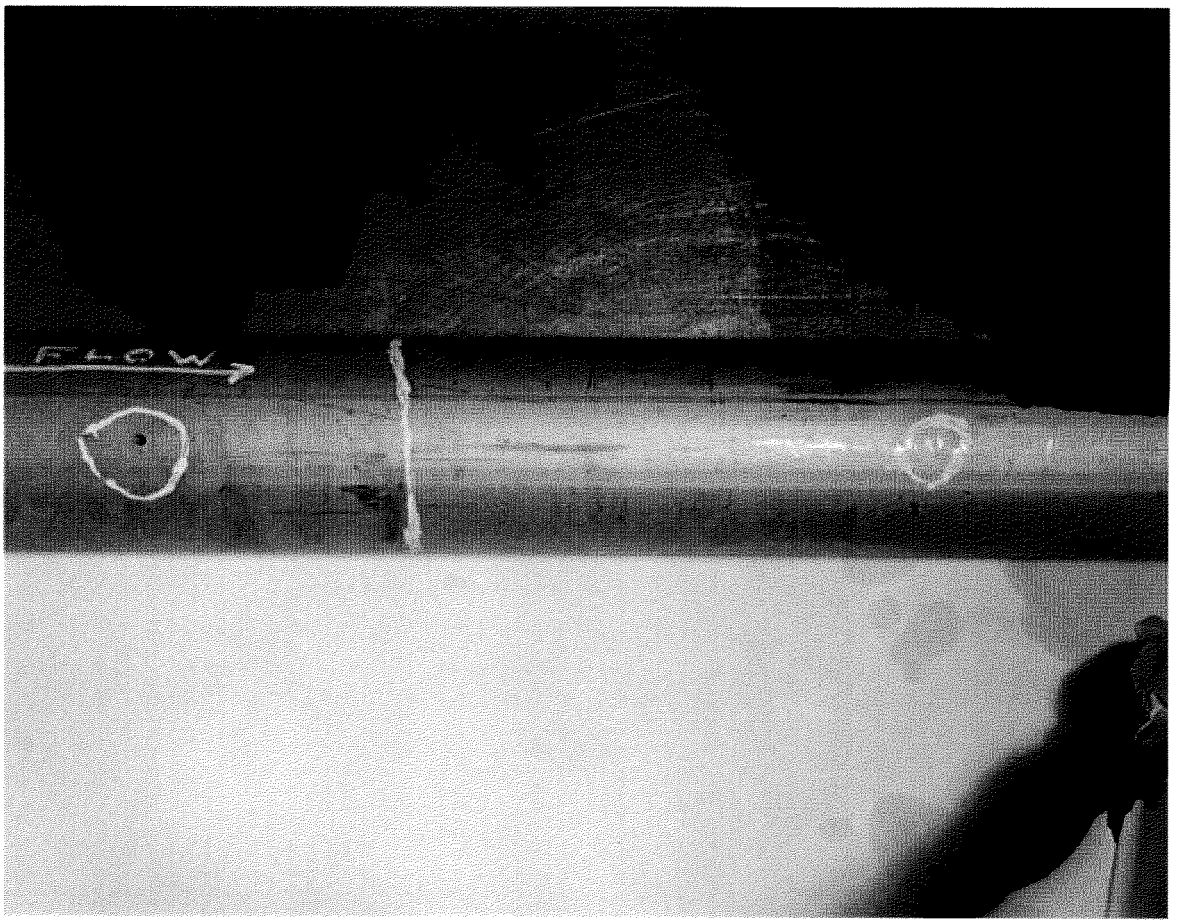

Figure 3-14. Drill hole found in waste-transfer line 3"PWA-1005 at CPP-28.

The position of the hole was such that no leakage could occur unless the waste-transfer line was at least one-half full of solution. This condition occurred only when pertinent block valves (valve box A6, etc.) in the waste transfer system downstream from the hole were closed during liquid waste transfer through the pipeline. The 3-in. line was not a pressurized line and instead used gravity drainage to transfer waste to the storage tanks. Normally, with diversion block valves in their proper open settings, solution transfer flow rates were insufficient to fill the 3-in. pipeline to the 50% full level. By design, any waste leaking through the hole should have been contained within the split-steel secondary containment and directed into downstream collection sumps. However, inspection indicated the encasement was badly deteriorated and partially filled with soil. The damming effect of the soil in the encasement caused sufficient liquid backup and flow outward through the joints of the encasement and into the surrounding soil.

From the data provided by the 11 test pipes, the zone of soil contamination was estimated to be approximately 9 ft in diameter by 2 to 3 ft in average depth below the pipe encasement at a depth of 7 ft bgs (Figures 3-15 through 3-17). Calculations made during the investigation estimated that approximately 128 ft^3 of contaminated soil existed at the site and the amount of contamination remaining was around 3,000 Ci. The calculations were based on the following assumptions:

- Radiochemical analysis of a typical first-cycle raffinate of the type typically transferred through the 3"PWA-1005 line indicated the concentration of total radionuclides was 46 to 50 Ci/gal (Allied Chemical 1974).

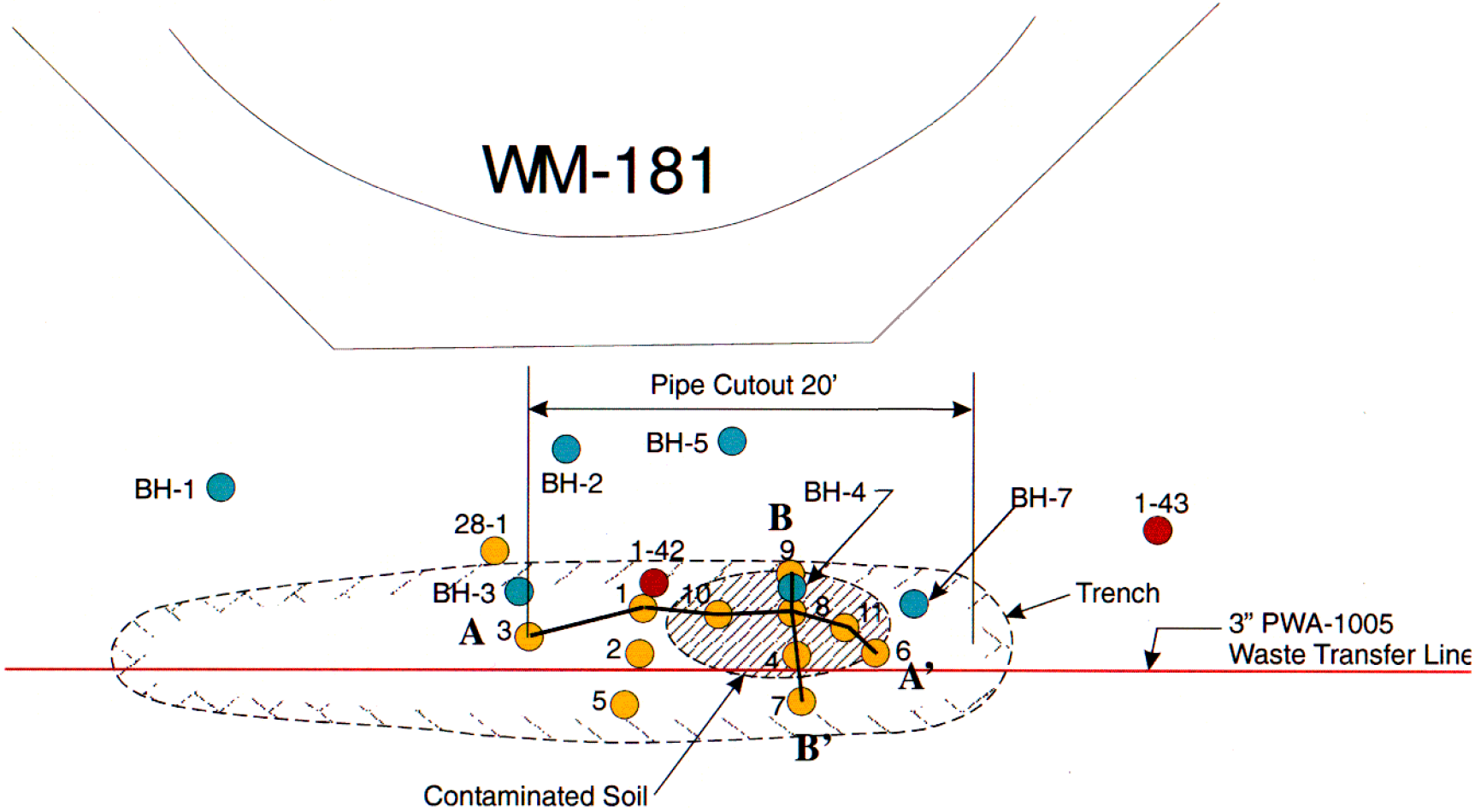

Figure 3-15. CPP-28 fence diagram location map.

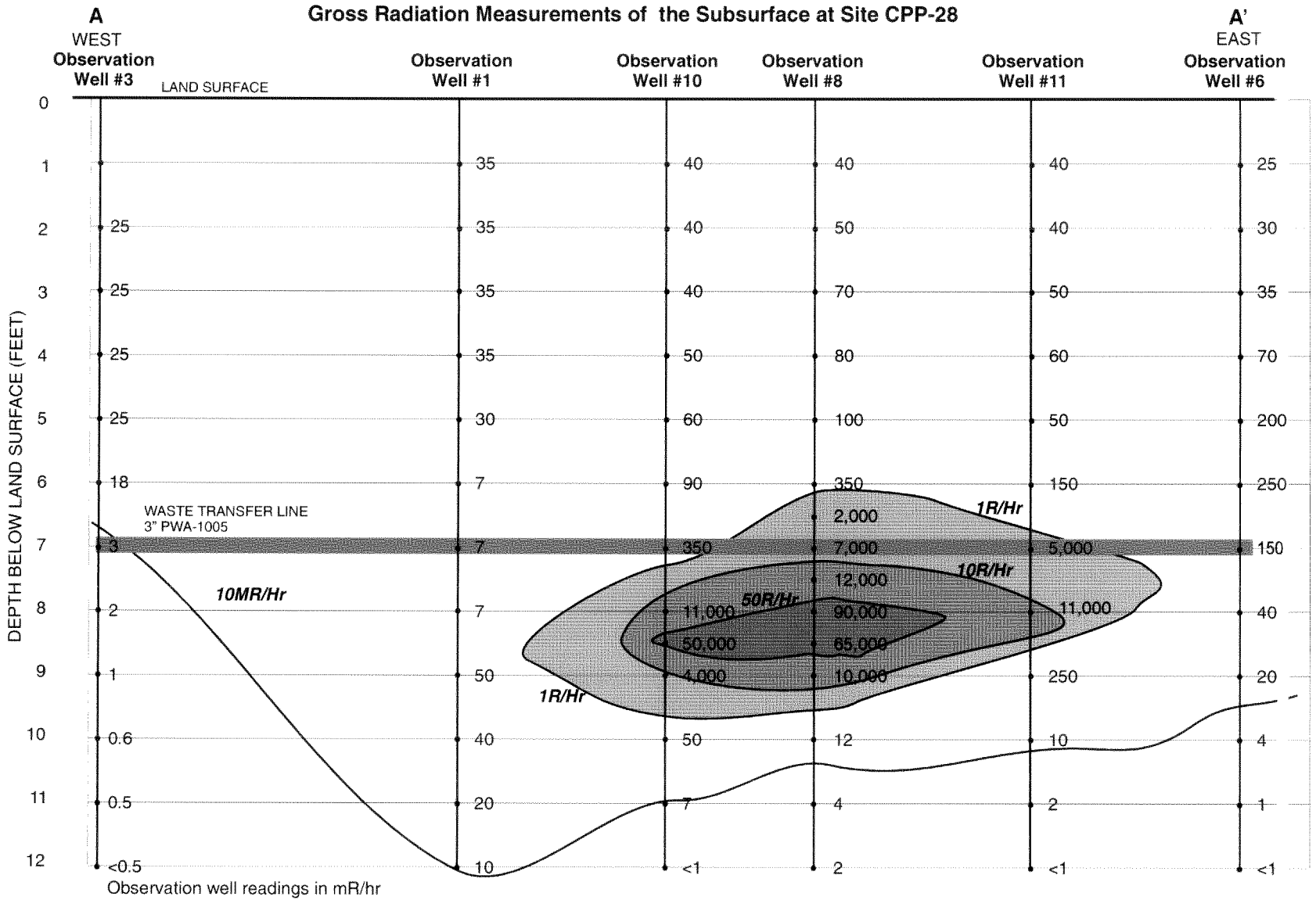

Figure 3-16. East-west fence diagram through the contaminated soil zone at CPP-28.

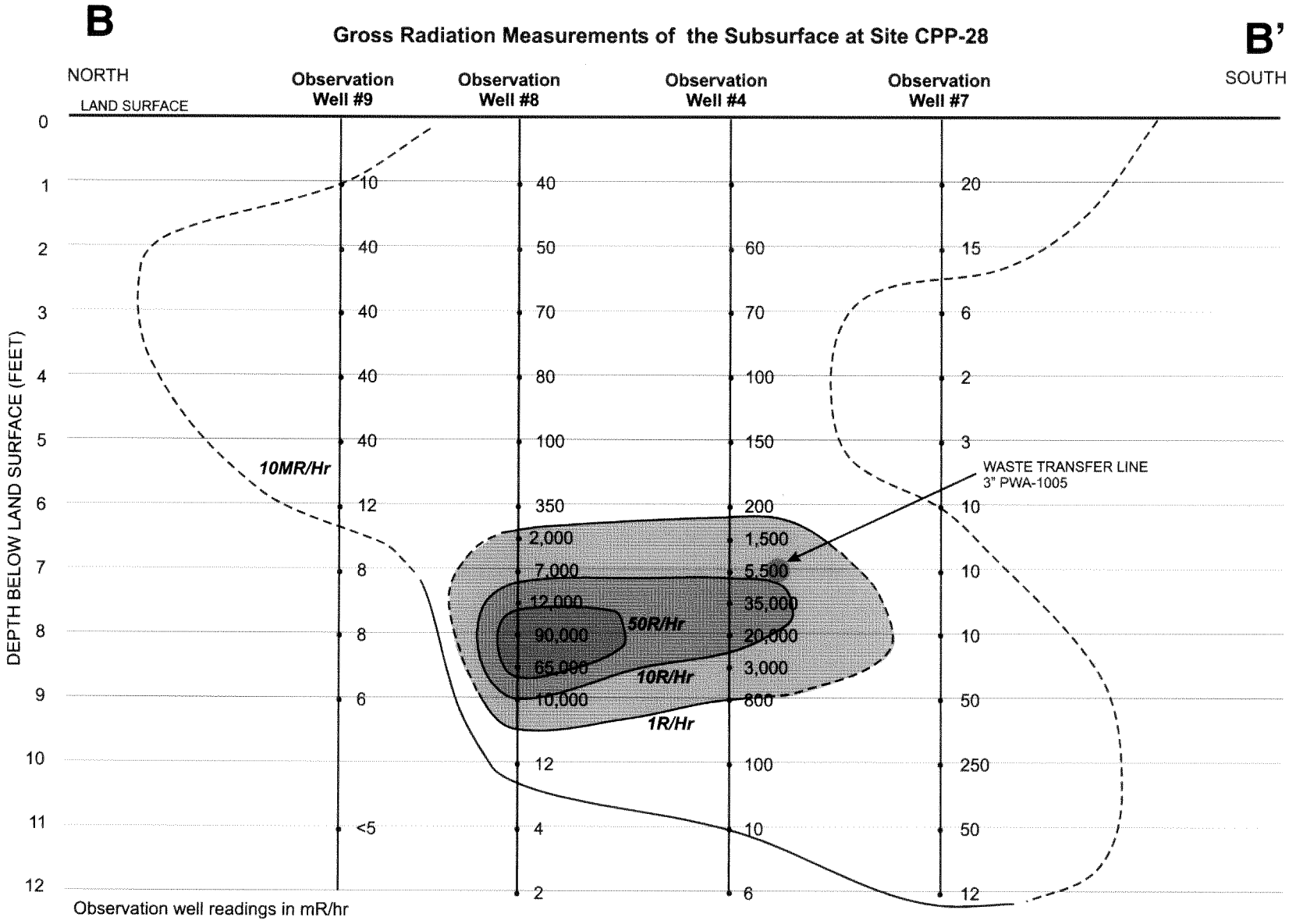

Figure 3-17. North-south fence diagram through the contaminated soil zone at CPP-28.

- The moisture content of the soil was determined experimentally to be 6% by volume.

- Using the volume of contaminated soil determined from the field investigation along with the moisture content and activity of the waste solution, a volume of 7.7 ft^3 (60 gal) would be held by the soil, which equates to approximately 3,000 Ci of activity.

Combining the activity remaining in the soil to that removed during the trenching portion of the investigation totals approximately 120 gal of waste solution that was released to the soil. Since an estimated 3,000 Ci of activity was removed based on radiation readings from the soil containers, a total of 6,000 Ci was estimated to have been released at the CPP-28 release location. The 46 to 50 Ci/gal activity used to estimate curies released included relatively short half-life radionuclides such as Ce-144 (284.6 days).

During the 1992 Track 2 investigation, an attempt was made to locate any of the 11 test pipes so that additional subsurface radiation readings could be collected. The new measurements were intended to update gamma readings in the test pipes and help determine if contaminant migration had occurred since the 1974 investigation. An area measuring 7 by 10 ft was excavated to a depth of 7 ft in an attempt to find the test pipes. The excavation location was selected based on historical photographs, plant drawings, and results of surface geophysical surveys. The test pipes were not found during the excavation activities, and subsequent evaluation determined that the excavation was located too far to the west, missing the test pipe locations. Therefore, it is uncertain whether the test pipes still exist at the site.

During the 1993 to 1996 tank farm upgrades, portions of sites CPP-28, -20, -25, and -79 were excavated. Excavation depths ranged from 0 to 35 ft bgs, with most being completed at approximately 15 ft bgs. Field beta/gamma radiation measurements encountered during excavation ranged from 0 to 5 R/hr. No reported contaminated soils were removed from this site during the construction work.

To estimate the curies of Cs-137 and Sr-90 released at CPP-28, the assumption was made that contaminated liquids were not immediately released to the soil at the start of tank farm operations. Over a period of years, the acidic nature of the waste likely eventually corroded the carbon-steel top of the secondary containment. During this corrosion period until failure, released waste would have been contained and directed to tank vaults. After secondary containment failure, waste liquids would migrate into the soil. Therefore, the first-cycle waste activities for Cs-137 from the late 1960s and early 1970s were used to establish Cs-137 and Sr-90 curie content of the waste that was released to the soil. Typical Cs-137 activities were 0.75 Ci/L for the period and would be the same for Sr-90. Using these two activities and performing a volumetric conversion results in an activity of 5.68 Ci/gal. This value was rounded to 6 Ci/gal for estimation purposes.

Using the rounded Cs-137 and Sr-90 volumetric activity level and multiplying it by the total number of gallons believed to have entered the soil results in a 720 Cs-137 and Sr-90 curie content. Assuming that half of the contaminated soil was removed, 360 Ci remain at the CPP-28 release site.

3.1.3 Site CPP-79

Site CPP-79 generally has been defined as soil contaminated in July and August of 1986 by the releases of waste solutions from the WCF and NWCF sump tanks due to improper valve settings in a transfer line buried about 10 ft bgs (Figure 3-18). However, during the Track 2 investigation conducted in 1992, deeper soil contamination was encountered in borehole CPP-79-1 at approximately 30 ft below the tank farm surface elevation. Based on field screening data, the deeper contamination was not believed to have been associated with the soil contamination at shallower depths. Therefore, CPP-79 has been divided into two contamination zones, CPP-79-Shallow and CPP-79-Deep, which are discussed in more detail in following sections.